The UNESCO Courier

A window open on the world

May 1970 (23rd year) - Price: 50 cents

CANCER

Let's face it
There's a lot we can do!

XUM

TREASURES
OF
WORLD ART

44

The Colossi of Polonnaruwa (Ceylon)

"As the dewdrop slips into the shining sea"; so, said the Buddha, man loses his individuality and merges with the universal life. The calm serenity of mind that came to the "Enlightened One" as he sat beneath the Bo-tree has been captured in this detail from a massive, 46 ft long statue of the reclining Buddha. It is one of three colossal statues of the Buddha carved by Ceylonese artists of the 12th century out of single blocks of stone in the now ruined city of Polonnaruwa, central Ceylon.

Photo © Charles Lenars, Paris

XUM

The UNESCO Courier

MAY 1970
23RD YEAR

PUBLISHED IN 13 EDITIONS

English
French
Spanish
Russian
German
Arabic
U.S.A.
Japanese
Italian
Hindi
Tamil
Hebrew
Persian

Published monthly by UNESCO

The United Nations Educational, Scientific and Cultural Organization

Sales and Distribution Offices
Unesco, Place de Fontenoy, Paris-7e.

Annual subscription (any edition) : $ 5.00
Single copies : 50 cents

The **UNESCO COURIER** is published monthly, except in August and September when it is bi-monthly (11 issues a year) in English, French, Spanish, Russian, German, Arabic, Japanese, Italian, Hindi, Tamil, Hebrew and Persian. Sales and distribution: UNESCO Publications Center, U. S. A., P. O. Box 433. New York, N. Y.,10016, MU 6-4707 (sole distributors of the U.S.A. edition).

Individual articles and photographs not copyrighted may be reprinted providing the credit line reads "Reprinted from the **UNESCO COURIER**" plus date of issue, and three voucher copies are sent to the editor. Signed articles reprinted must bear author's name. Non-copyright photos will be supplied on request. Unsolicited manuscripts cannot be returned unless accompanied by an international reply coupon covering postage. Signed articles express the opinions of the authors and do not necessarily represent the opinions of UNESCO or those of the editors of the **UNESCO COURIER.**

The Unesco Courier is indexed monthly in the Readers' Guide to Periodical Literature and in Current Contents - Education, Philadelphia.

★

Editorial Offices
Unesco, Place de Fontenoy, Paris 7e, France

Editor-in-Chief
Sandy Koffler

Assistant Editor-in-Chief
René Caloz

Assistant to the Editor-in-Chief
Lucio Attinelli

Managing Editors
English Edition : Ronald Fenton (Paris)
French Edition : Jane Albert Hesse (Paris)
Spanish Edition : Francisco Fernández-Santos (Paris)
Russian Edition : Georgi Stetsenko (Paris)
German Edition : Hans Rieben (Berne)
Arabic Edition : Abdel Moneim El Sawi (Cairo)
Japanese Edition : Takao Uchida (Tokyo)
Italian Edition : Maria Remiddi (Rome)
Hindi Edition : Babu Ram Saksena (Delhi)
Tamil Edition : T.P. Meenakshi Sundaran (Madras)
Hebrew Edition : Alexander Peli (Jerusalem)
Persian Edition : Fereydoun Ardalan (Teheran)

Assistant Editors
English Edition : Howard Brabyn
Spanish Edition : Simon Izquierdo Perez

Photo Editor : Olga Rödel

Layout and Design : Robert Jacquemin

All correspondence should be addressed to the Editor-in-Chief in Paris

Nº 5 - 1970 MC 70-2-255 A

Page	
4	**CANCER—WHERE WE STAND** *By John Higginson*
10	**CIGARETTES AND CANCER** *By Sir George Godber*
14	**THE CASE AGAINST SMOKING** *By Robert M. Taylor*
17	**PROBING THE SECRET OF THE CELL** *By Nicolas Odartchenko*
18	**PICTURE OF A SPREADING TUMOUR**
23	**A FALSE NOTION : CANCER = INCURABLE** *By Eric C. Easson*
24	**1,500,000 AMERICANS CURED OF CANCER**
27	**HIDDEN FACTORS IN THE 'GEOGRAPHY' OF CANCER** *By Nedd Willard*
30	**AIR POLLUTION AND LUNG CANCER** *By R.E.Waller*
33	**LETTERS TO THE EDITOR**
34	**UNESCO NEWSROOM**
2	**TREASURES OF WORLD ART** The Buddha of Polonnaruwa (Ceylon)

Cover

The background information on cigarettes and cancer assembled in the preparation of this issue so impressed the Editors of the Unesco Courier that six of them, including the Editor-in-Chief and the Managing Editor, have given up smoking. We thought that this bit of news would interest our readers.

Photo WHO - American Cancer Society

"Cancer claims a steady toll of human lives all over the world and in many countries it is second only to diseases of the heart and arteries as a cause of death. It is also a disease which arouses strong emotions. Cancer is a subject many people prefer to shun; a disease which is commonly, and wrongly, believed to be untreatable; a disease from which many people die or suffer needlessly because, whether from ignorance or unreasoned fear, they do not seek advice until it is too late." These words by Dr M.G. Candau, Director-General of the World Health Organization, explain why WHO has chosen as its theme for 1970, "Early detection of cancer saves lives." This issue of the "Unesco Courier" was prepared in collaboration with the Office of Public Information of WHO and the International Union Against Cancer.

CANCER where we stand

by John Higginson

THE increasing disillusionment during recent years among both the lay public and the scientists in the absence of an immediate breakthrough in either the treatment or prevention of cancer has tended to lead to excessive pessimism.

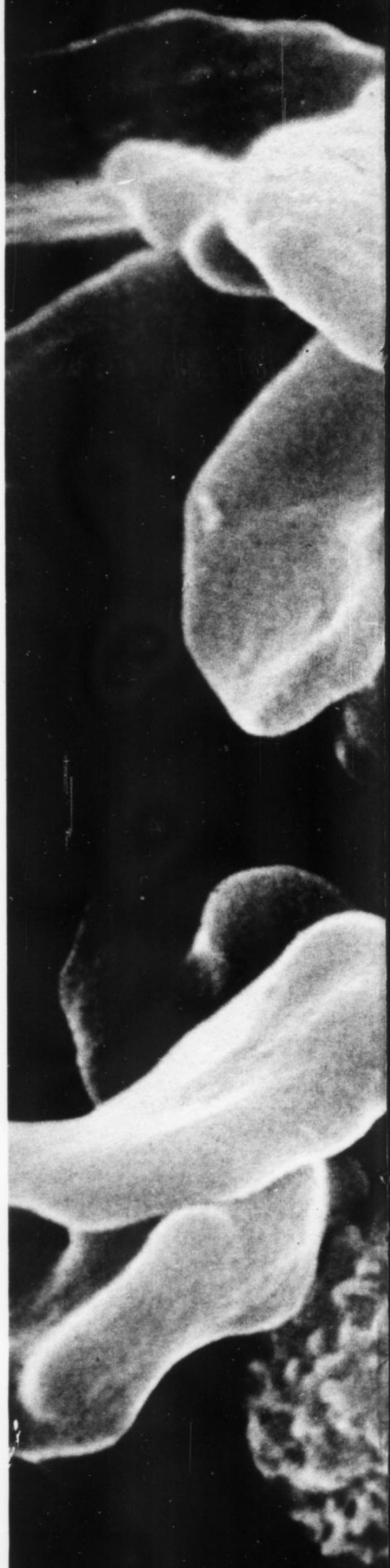
This attitude probably results from the expectations engendered by the exciting progress in molecular biology and chemotherapy in the late fifties and early sixties which appeared to offer immediate solutions to the problem and gave rise to claims that were often widely and uncritically disseminated in the lay press.

Though our brightest hopes have not been fulfilled and the malignant cell has been shown to be more complex than used to be thought, the progress made in cancer research during the last two decades is considerable and offers much hope for the future.

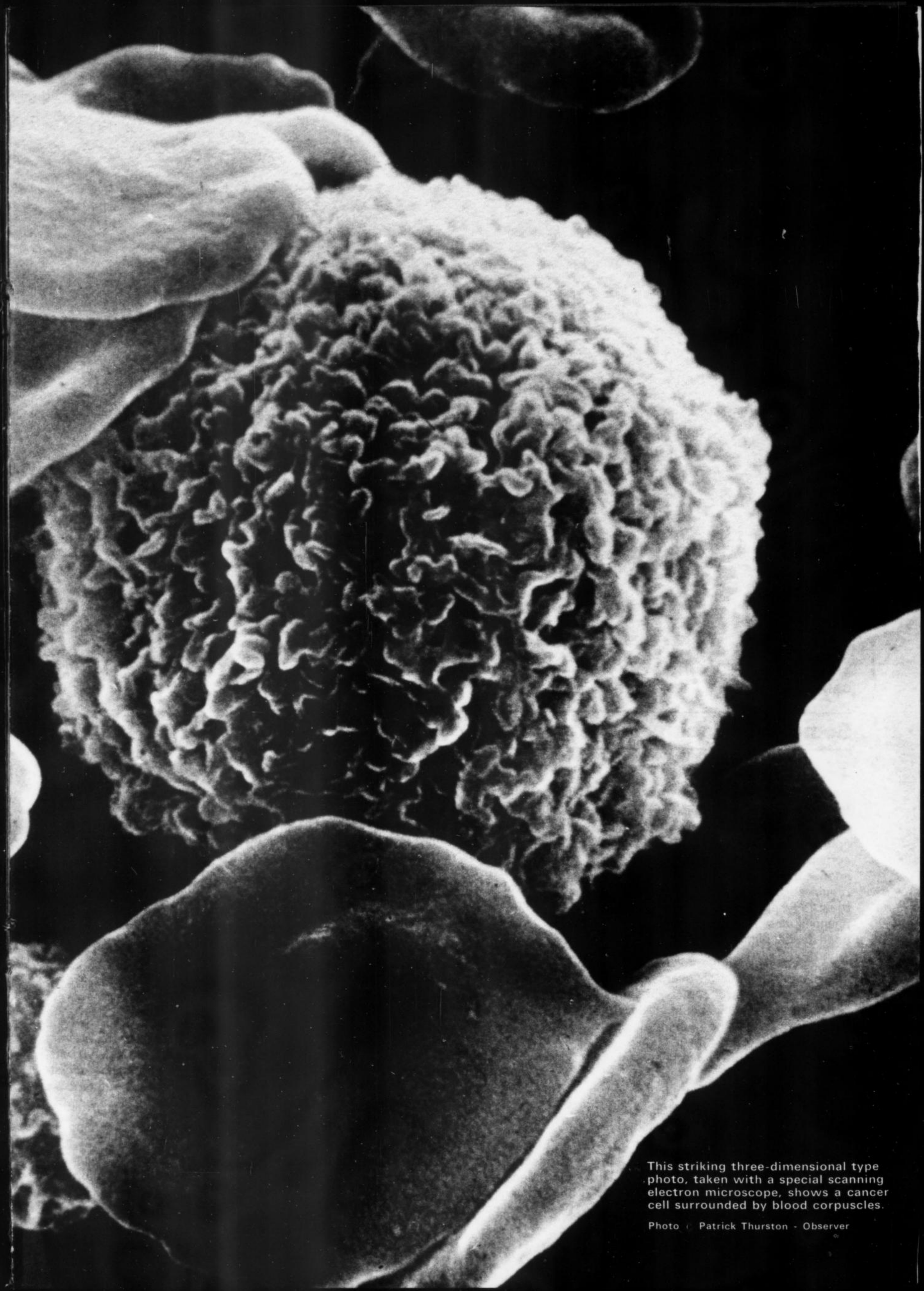
For some time, scientists have warned that the immediate future may not provide quick solutions to complex biological problems and that we should be prepared for a period of steady, if less spectacular, progress. Many people, however, have become so accustomed to the concept of "breakthroughs" that the many years of careful work which

CONTINUED PAGE 6

JOHN HIGGINSON *has been director of the International Agency for Research on Cancer, at Lyon, France, since 1966. Born in Ireland and now a citizen of the United States, he has been particularly concerned with the geographical and environmental aspects of cancer, and directs the International Agency's research work on viruses and chemical agents in cancer and their relation to environment. This article appeared in the Feb-March 1970, issue of "World Health", published by WHO.*



XUM



This striking three-dimensional type photo, taken with a special scanning electron microscope, shows a cancer cell surrounded by blood corpuscles.

Photo : Patrick Thurston - Observer

XUM

Some astonishing facts and figures

make them possible are frequently forgotten.

While prophecies in science are notoriously fallacious and solutions to certain cancer problems may arise sooner than expected, past experience requires that cancer research be regarded as essentially long-term; financial and manpower requirements need to be planned accordingly.

To speak of a single solution to the "cancer problem" is an oversimplification. From several point of view, cancer of each individual organ in the body should be regarded separately since each may require a different approach. Nonetheless, there are certain common features of malignant disease which justify consideration of cancer as an entity, especially when problems at the cellular level are under investigation.

During recent years, the absolute number of cancer cases has risen in industrialized states. This is due in the first place to the increasing proportion of elderly people in the population who are prone to cancer. This rise does not represent a true increase in frequency but reflects improved medical care and increased expectation of life that have followed the control of such infectious diseases as tuberculosis.

Secondly, there has been a large increase in lung cancer incidence during the last two decades, especially among males. The increase in cancer of other sites has been less marked or is negligible. In fact, in most developed countries, the frequency of stomach cancer is declining for reasons not understood but which would appear to be associated with an improved standard of living. Thus, one cannot speak of a general cancer increase in modern industrial society.

The remainder of this article will discuss certain highlights of the last two decades which illustrate best the immense increase in knowledge which has occurred in relation to this disease and which has formed the base on which future research programmes can be developed in a rational manner.

Much of this information has now raised a whole series of new problems, both at the sociological as well as at the molecular level, and not all of these problems are susceptible to solution by available technology.

There are two major long-term objectives in relation to cancer research:

■ *Cancer Prevention.* This is the ideal solution as its aim is to prevent cancer and thus avoid the heavy costs, both economic and physical, associated even with successful treatment.

■ *Cancer Treatment.* Since it is unlikely that complete prevention of all cancers will be possible within the foreseeable future, continued attempts to seek new and improved methods of treatment are continuing to demand a high priority.

XUM

THE PHANTOM HAND

In recent years thermography has become a valuable aid in the early detection of cancerous tumours. Tumours are hotter than healthy areas of the body and thermography consists of producing images based on heat variations. The hotter zones appear white and the colder areas dark. Far left, a thermograph of a human profile. In the photo, top left, two hands were placed on a table and a thermograph made. Shortly afterwards, a second thermograph was made (lower left) after one hand had been withdrawn. The phantom hand which remains visible represents the heat transferred to the table The use of thermography has had startling results in detecting breast cancer.

Photos © Laboratoires d'électronique et de physique appliquée, Limeil-Brevannes, France

Studies on the epidemiology of cancer have produced some of the most significant clues regarding the causation of cancer in man.

While attempts have been made since the beginning of the 19th century to collect statistics, Livingstone could still write a hundred years ago that "cancer is a disease of civilization". However, significant progress in the collection of cancer data has been made since the second World War and adequate statistics are now available to enable assessment of cancer patterns under a wide variety of environmental conditions.

Cancer affects all races and communities, but there are marked differences in the frequency with which various organs are affected: for example, cancer of the liver and of the mouth are more frequent in southern Africa and in India respectively than in Europe and North America, whereas the reverse is true for cancer of the large intestine. Other studies have shown that migrant populations develop the cancer patterns of the country to which they migrate and not that of the country of origin.

These facts have been most important in preventing undue emphasis on genetic factors in man and in indicating that most cancers are primarily influenced by environmental factors, though they may be modified to a minor degree by individual susceptibility. Skin cancer is an important exception in that it is significantly affected by pigmentation.

The recognition that most cancers are not inevitable but are caused by environmental factors has had important practical results in directing increased research to identify these factors as a first meaningful step towards prevention.

The demonstration of a group of individuals who show an unusual frequency of a cancer has been of great assistance in relation to identifying tumours of occupational and cultural origin, since individuals in these cases are exposed to unusually high concentrations of a carcinogen similar to that found in the laboratory.

Nearly 200 years ago, Percival Potts demonstrated that cancer of the scrotum and skin was very frequent among London chimney-sweeps. He ascribed these tumours to the soot with which their clothes were continually impregnated. With different methods of heating and improved standards of living, chimney-sweep cancer has largely disappeared.

High-risk groups have been identified in many industries. Today, legislation to prevent cancer is enforced in most industrialized countries and the worker is protected either by better techniques or by substituting safer compounds for the dangerous agent.

However, these success stories are often forgotten by the public, since once a cancer has been controlled it no longer represents a problem of interest. Examples of such disappear-

CONTINUED NEXT PAGE

50,000 new drug compounds tested each year

ing industrial tumours include bladder cancer in dye workers and osteosarcomas in watch-makers. Yet the continual development of new man-made chemicals as well as changes in technology require constant vigilance on the part of the industrial doctor, and industrial techniques must be continually monitored to avoid the introduction of possible new hazards.

Since the identification of a hazard by the appearance of a tumour in man clearly represents a failure in prevention, large-scale programmes operate today in many countries to test the potential cancer-producing properties of new chemicals.

Unfortunately, facilities are insufficient to test all new chemicals in the environment, even in the most industrialized countries. Further, the extrapolation of results of animal tests to man is complex and involves many difficulties.

Thus, while it is generally agreed that substances carcinogenic to animals should not be utilized by man unless essential, it should not be forgotten that all but two of the many stimuli known to be carcinogenic to man were first identified in man and not in animals. Furthermore, some substances identified as carcinogenic to animals would appear relatively harmless to man at the levels to which he is exposed.

OTHERS, such as drugs and pesticides, may offer benefits which for the moment would appear to outweigh their cancer-producing potential. It is possible in some cases that their elimination may lead to greater tragedies in terms of health and nutrition than would result from their utilization.

For example, pesticides in malaria control and food production have saved tens of thousands of lives. Isoniazid has been essential for the treatment of tuberculosis and there is no evidence that it has carcinogenic properties in man although it has produced lung tumours in mice.

It is recognized that the public health official today must take calculated risks based on the available data. Studies made in the last two decades indicate how such data may be collected by the use of appropriate epidemiological techniques.

In conclusion, the advanced public health measures of today which monitor our water, air and food for cancer-producing agents are far advanced in comparison with the situation at the beginning of this century, and represent steady, if unspectacular, progress.

The relation of a cancer to a cultural habit provides one of the greatest success stories of modern cancer research. Twenty years ago a firm association was first demonstrated between cancer of the lung and the cigarette habit in man, although the relationship had been suspected for much longer. Numerous additional studies have now placed this causal association beyond any reasonable doubt and, although other factors such as air pollution may be significant, in the absence of cigarette smoking they are of relatively little importance.

The potential benefits of this discovery can be illustrated by the situation in the United Kingdom where nearly 40 per cent of all cancer deaths in man are due to lung cancer. Failure to achieve this level of prevention results from the unwillingness of the average individual to accept that a pleasurable habit is dangerous. However, there is evidence that with increasing education smoking will gradually begin to diminish.

More than 500 representatives of 35 countries attended the first World Conference on Smoking and Health in 1967 and it was interesting to note that in some countries a significant proportion of doctors have ceased smoking or switched to pipes or cigars. Intensive research is now being directed towards identifying exactly the hazardous stimuli in cigarette smoking and developing safer cigarettes.

Cigarette smoking and excessive drinking have also been implicated as major factors in cancer of the oesophagus and mouth in many areas. In India, mouth cancer which accounts for approximately one third of all cancers in males has been shown to be related to betel chewing. Again, prevention is theoretically possible.

Unfortunately, little is known about the cause of many cancers including cancers of the stomach, colon, rectum and breast and leukaemia. However, the many potential chemical carcinogens which may contaminate food or air are being investigated.

Recently, new groups of compounds which occur in nature and contaminate food have been discovered and are now being studied for their effects on man. Moreover, as our knowledge of events at the molecular level of the cell increases, it may eventually be possible to determine in advance those chemical compounds that are potential carcinogenic hazards.

INFORMATION services have markedly improved and the data obtained in one laboratory is now rapidly transferred to another in the same or different countries, although at times in some countries certain industries have not always been as collaborative as the situation warrants.

It is therefore possible to state that during the last three decades research on chemicals carcinogenic for man has been placed on a rational basis, which is essential for the final identification of the compounds concerned. Defining the potential problem has also indicated the limitations of financial and physical support since it is estimated that over a quarter of a million new compounds are synthesized each year, of which between 5,000 and 10,000 require testing.

Viruses were first identified as causing experimental cancer in birds in 1908. During the last two decades it has been demonstrated that they cause leukaemia in several species, including dogs, cats and cattle. There is now, moreover, increasing circumstancial evidence that they may also be associated with certain types of human cancer—for example, Burkitt's lymphoma, a childhood disease in Africa, in which the virus shows the same properties as that which causes infectious mononucleosis, a relatively mild and common blood disease. A very similar virus has also been discovered more recently in tumours of the post-nasal space.

Major attempts by large-scale sero-epidemiological surveys of a type unforeseeable even a few years ago are now being planned to find out whether this relationship is causal. While certain common human viruses such as the adenoviruses which may cause the common cold have been shown to be carcinogenic, their role remains unproven in man.

The virus concept has been of great value in elucidating mechanisms of cellular metabolism, especially in relation to nucleic acids. Since the

carcinogenic viruses are composed of a core of either DNA or RNA, much has been learned of how such viruses may modify the cell's own nucleic acid following infection, with the resultant neoplasia.

The potential nature of these discoveries will become clearer during the next decade, when the role of viruses in human cancer will almost certainly be clarified; evaluation of control methods should follow. The progress in developing new concepts of malignant disease introduced by the virus hypothesis may be difficult to appreciate by those not engaged in this field, but this work has modified many concepts of cell control and the progress of the past fifteen years will probably be more easily appreciated in the light of the successes of the next decade.

Not only have the standard methods of surgery and radiotherapy been improved, but chemotherapy has made giant progress since 1947 when it had just been shown that acute leukaemia in children could respond to drugs. Since then a vast number of new compounds has been developed and studied. In the USA alone, 50,000 compounds are screened each year.

The use of these compounds in leukaemia in various combinations and with other forms of treatment has brought great improvements: whereas in 1964 complete remission of leukaemia was found in only 40-50 per cent of cases in children and the median survival was one to one and a half years, in 1967 complete remission was possible in over 90 per cent of children and the median survival had risen to three or more years.

Data collected from many countries would indicate that today it is even possible to believe that some leukaemia patients have actually been cured and further successes would appear probable. A complete cure by chemotherapy is now also possible in a proportion of patients with Hodgkin's disease and choriocarcinoma, and possibly also Burkitt's lymphoma in Africa.

However, gains are small against the major cancers, colon, rectum and breast, where the surgeon and the radiotherapist are still responsible for most treatments, and stomach and lung cancers, which are still highly refractory to therapy. However, the five-year survival for cancer of the colon increased from 31 per cent of cases in the early forties to 46 per cent in the late fifties.

It is clearly fundamental to the application of the classical therapies that the patient be seen early enough in the course of his disease to permit adequate treatment, and much progress has been made in techniques that may prove valuable in identifying cancer at an early age.

These techniques largely rely on the identification of malignant cells in various secretions of the body. Unfortunately, they are not always utilized by those who most need this type of examination, even when available. Thus far, their overall effect on mortality has been relatively slight; however, the whole concept of early diagnosis and, thus, possible curative treatment has had a radical influence on modern therapy.

CANCER is a disease of the cell. A widely accepted hypothesis is that an initial event leading to a change in a single cell may result in a series of events within succeeding generations of cells, culminating in a tumour.

Whereas progress as indicated by actual improved therapy or meaningful prevention has not yet resulted from developments in the field of molecular biology, there is no doubt that progress in this area offers the best and most rational long-term approach to cancer prevention and therapy.

As our knowledge of the factors involved in cell control, multiplication, transformation and drug resistance increases, it is not improbable that the progress of the last decade will be regarded as the watershed of our understanding of the neoplastic disease at the basic level.

Another related field in which much progress has occurred is that of immunology, which has developed during the last fifteen years from a discipline which was believed to have no relevance to cancer, to one that now shows great promise not only in relation to therapy but also in diagnosis and control.

In conclusion, it is obvious that very significant progress has been made in all aspects of cancer research during the last decade, which has resulted in improved therapy and prevention. The fact that expectations have not been fully realized only reflects the complexity of the problem and not lack of progress; the efforts of the many dedicated workers in this arduous and non-spectacular field should be recognized. Furthermore, cancer studies have provided considerable "spin off" for other branches of medicine, a fact which is often ignored. ■

Photo WHO

A model of the International Research Centre on Cancer now being built in Lyon, France. It will house the International Agency for Research on Cancer, set up in 1965 with the help of WHO, and headed by Dr John Higginson, the author of this article.

XUM

Cigarettes and cancer

by Sir George Godber

TOBACCO has been in use in Europe for less than 400 years. It has been smoked in pipes, cigars and cigarettes and it has been taken as snuff. It has been praised by many and, until the last twenty years, condemned by relatively few. Factory-made cigarettes have come to be by far the commonest means of smoking tobacco only during the twentieth century. But during this century the production and smoking of cigarettes so greatly increased that their ill effects have been most forcibly brought to medical and then to public notice, especially in the last twenty years.

The first serious contributions to medical literature about the dangers of smoking were made twenty years ago in Britain and the United States. Since the early 1930s, cancer of the lung had been increasing rapidly amongst the causes of death and two enquiries demonstrated that most patients with cancer of the lung had been cigarette smokers.

Those first two enquiries made a prima facie case but they were followed by much more detailed studies which, over the next ten years, proved up to the hilt the causal relationship between cigarette smoking and lung cancer. In those ten years, the number of deaths from lung cancer in men in Britain went up again by 74 per cent and the number of deaths from the same cause in women began to increase.

It takes a long time to produce a cancer and that is why it took so long for us to realize that the increase in the use of cigarettes twenty or thirty years earlier was the cause of death from cancer so many years later. Cancer of the lung can occur in people who have not smoked but, among heavy smokers, those who smoke perhaps 40 cigarettes a day or more, it occurs twenty times as often.

In some people, like uranium miners or workers exposed to asbestos dust, lung cancer occurs more commonly still, but almost entirely amongst those who are cigarette smokers. It occurs more often in people living in big cities than those who live in the country, but again the increase is in the cigarette smokers ; also, the city dweller often smokes more cigarettes than the man who lives in the country.

The studies of lung cancer in smokers naturally lead to consideration of other causes of death, and this has shown that two common causes, bronchitis and coronary thrombosis in younger men, are also much more common in cigarette smokers. Probably a lot more people die each year from these conditions brought on or aggravated by cigarette smoking than from lung cancer. There are other less common cancers, of the mouth, throat and gullet and even of the bladder and liver, which are all more frequent in cigarette smokers than in non-smokers.

In fact, the man who smokes twenty or more cigarettes a day from the age

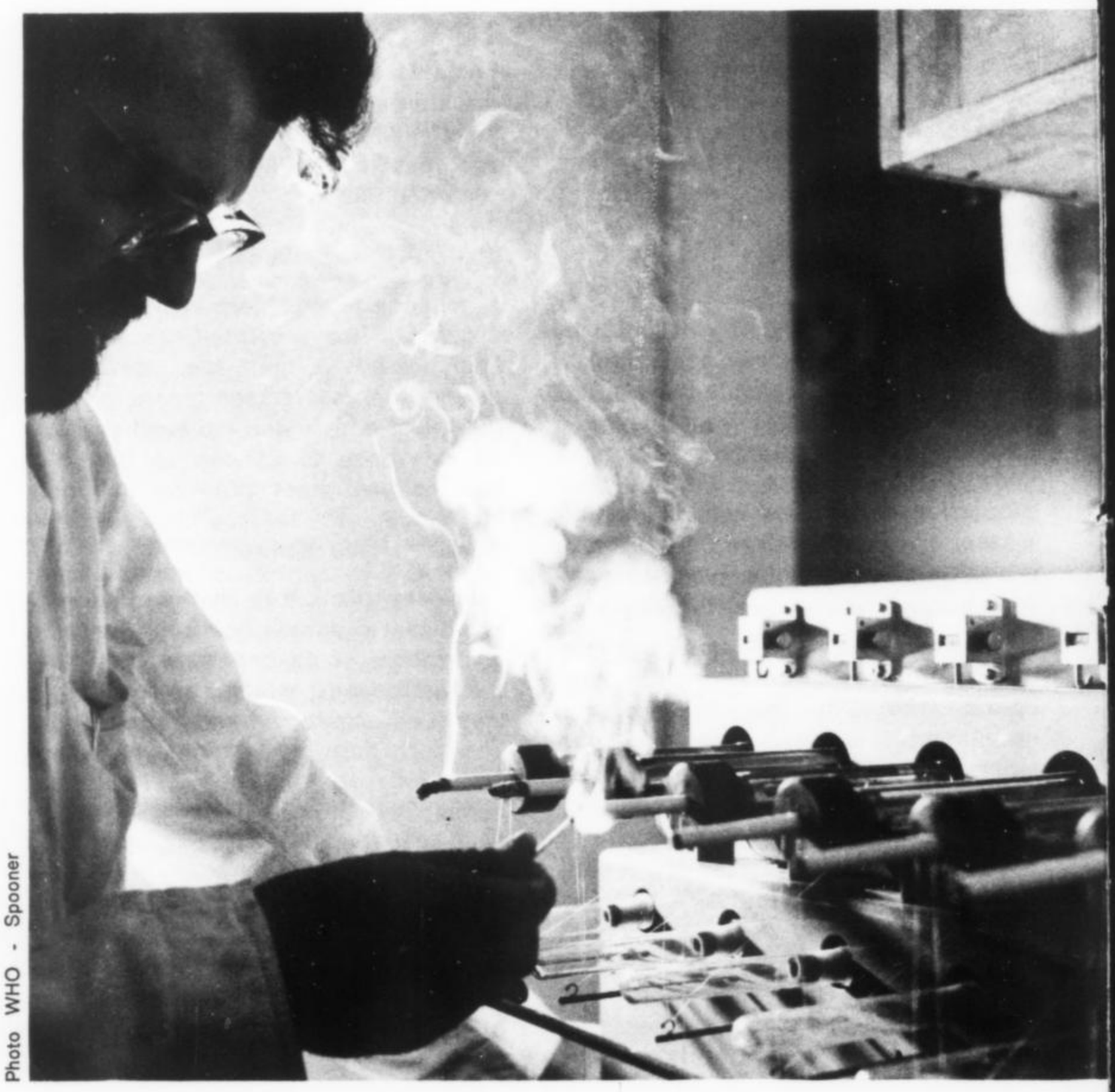


Photo WHO - Spooner

SIR GEORGE GODBER *is Chief Medical Officer to three government departments or ministries in the United Kingdom: Dept. of Health and Social Security; Dept. of Education and Science; the Home Office. He has represented the U.K. as chief delegate to every World Health Assembly since 1961, and has written widely on medicine and public health. This article appeared in the Feb-March 1970 issue of "World Health".*

of twenty onwards is likely to live five years less than the non-smoker of the same age, and if he smokes forty or more he is likely to live eight years less. The man of fifty smoking twenty cigarette a day has double the chance of dying in the next ten years than the non-smoker.

In Britain, probably more than 50,000 people die each year from diseases brought on by smoking cigarettes. Of course a lot of them are older men, but it has been calculated that at least 150,000 years of working life before the age of 65 are lost each year in Britain for this reason. Similar calculations in the United States give much the same answer, as do enquiries in Canada, Denmark, Holland, Sweden and Norway.

At this time Britain probably suffers more than most of the other countries. That may be due to a longer history of heavy cigarette smoking, to the fact that British men smoke more of each cigarette than do Americans, and perhaps because more of Britain's population live in crowded cities.

Most of the attention has been given in the past to lung cancer but the less dramatic diseases, chronic bronchitis and emphysema, are a great deal more damaging to health generally because they cause long periods of invalidism before they kill. Coronary thrombosis, too, may cause long periods of invalidism if it does not cause sudden death. Furthermore, the chronic bronchitic dying after years of increasing disability may have had a miserable life and the man who survives a coronary thrombosis may suffer severe limitation of his activity for his remaining years.

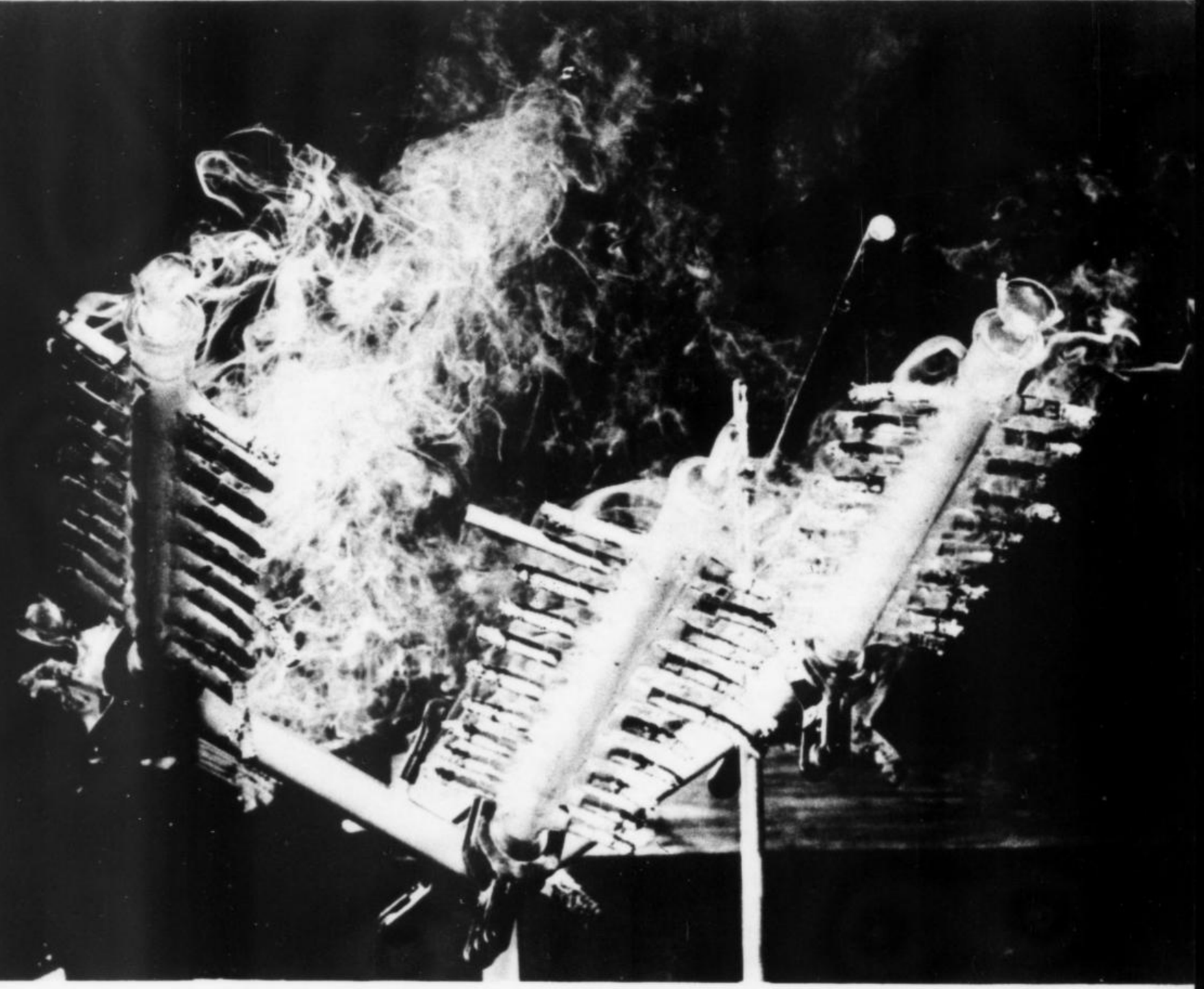
THE United States Public Health Services have given us a lot more detailed information about the effect of smoking in causing ill health, apart from a fatal end result. Surveys there show that the cigarette smoker has twenty per cent more days of sickness absence from work a year than the non-smoker and the more he smokes the greater the discrepancy. We have no comparable figures for Britain but we know that chronic bronchitis causes a tenth of all Britain's sickness absence from work each year, and it seems highly probable that the total loss of working time due to smoking is at least of the order found in the American enquiry.

The ill effects of cigarette smoking are not just limited to older people. An enquiry amongst schoolboys in Britain showed that those who smoked suffered more from coughs and ill health generally than those who did not; it is easy to show that even one cigarette produces at least a short period of reduced respiratory efficiency.

In those countries where the evil effects of cigarette smoking have been fully investigated there is by now almost universal acceptance that the ill effects are real. It probably isn't true however that they are fully understood. Except in Italy, cigarettes are still advertised widely. Most of the advertisements are cleverly designed to display smoking as an adult activity helping in social contacts, even associated with virility and, in every way, a social benefit.

Advertising experts are certain to use those arguments that they think are most persuasive with the group that needs to be persuaded. Since adults who already smoke are likely to go on, it is young people who most need persuasion. Consequently, almost all the advertisements one sees are much more likely to attract the young than the old.

CONTINUED NEXT PAGE



Research into the rising number of deaths from lung cancer shows that this is primarily due to the rise in cigarette smoking. Lung cancer in 1970 will kill approximately 62,000 persons in the U.S.A. (51,000 men and 11,000 women). This death rate for men is thirteen times higher than it was 35 years ago. Scientists have designed smoking machines to help investigations of the chemistry and mechanics of cigarette smoking in relation to lung cancer. Here, two of these robot smokers puff away at a battery of cigarettes, from which tobacco tars and other substances are collected for examination in experiments.

Photo WHO - American Cancer Society

XUM

'Cigarette smoking responsible for a tenth of all deaths in Britain'

More than half of the American men, and probably three fifths of British men, smoke cigarettes. Every one who does acts as a persuader of the non-smoker just as every parent, schoolteacher or favourite athlete who smokes in public influences young people, however unconsciously.

It has been shown that parents and schoolteachers have a great influence in inculcating the habit in children. That sort of example leads young boys to smoke as a way of demonstrating they are grown up, especially if smoking is prohibited for them. Altogether, in most of the countries with a high level of social organization and a high standard of living, smoking is the norm and it is the non-smoker who is unusual.

Yet some groups especially conscious of the ill effects have clearly responded to the facts. In Britain nearly two-thirds of doctors used to smoke cigarettes, now less than one-third do, in the United States not much more than a fifth. British doctors may have started reducing their smoking earlier; they certainly benefited from it more than their fellow citizens because in the period when the lung cancer death rate went up by 25 per cent it fell among doctors by 30 per cent. That was just the period when the proportion of doctors smoking was sharply reduced.

WITH all this evidence, the reasonable man may well ask why anyone goes on smoking cigarettes. Especially why do they go on when, on present evidence, if they must smoke, a pipe or cigar is so much less dangerous. To understand that, one has to look at the reasons why people smoke.

Few people like smoking immediately and yet they will go on until they do get the pleasurable effects. In a society where smoking is the rule and non-smoking the exception, one can well understand the adolescent persevering with something that makes him appear an adult. There is also a strong urge to conform to his contemporaries and, nowadays, an equally strong urge for girls to copy the males of the same generation.

For most young people there is little to deter them except the cost, and few of the arguments against smoking are ever put with anything like the force, repetition or continuity of the pressure in favour of smoking. The threat of an earlier death, at what then seems a remote age, simply doesn't concern them.

Everyone knows that only a minority of smokers suffer lethal consequences and that kind of threat could hardly be expected to have any effect at all on the very young. What few of them realize is that cigarette smoking brings an almost certainly greater frequency of illness even from the earliest age and a loss of physical capacity in some degree.

One British study of attitudes towards smoking shows that about half the smokers habitually use cigarettes in some social situations rather than because of any craving for them. These are the people who like to smoke, and who use the cigarette to ease their position by conformity with the behaviour of the group; it has become a habit in certain situations in order to have something to do, to have something in the mouth or just to relax.

These are the people who are habit smokers. They are not driven by the necessity that affects some addicted smokers and they could probably stop quite easily if they were really convinced that it was worth the inconvenience of unlearning the habit. There is temporary strain on the individual in changing his pattern of behaviour and probably half the smokers simply won't face that.

The other half are really much more dependent upon smoking and frequently these are just the people who know that they should stop. Very often they have tried and failed; in a society predominantly of smokers everything is against them because it simply isn't possible to get away from the things that might stimulate them to start again. Others smoking, ashtrays and an ample supply of cigarettes deepen their own feelings about deprivation in addition to exposure to advertisement on every hand. Some people call this addiction, some habituation, but it doesn't really matter what we call it if the man who has this feeling about smoking simply cannot break away.

IF this rough division is right, and half the smokers could stop if they were really persuaded, perhaps we need most of all to work on this group. We need to get the message across to them that there are enormous benefits to be had in terms of their own health, and that of the health of their children or pupils, who would no longer have the example of a smoking parent or teacher. There are even economic benefits, since, in Britain, the cost of buying 20 cigarettes a day could feed a member of the family.

Perhaps our society hasn't faced the brutal truth that we really want to get rid of the cigarette. With so much involved in commerce and agriculture and so much government income from taxation, it isn't surprising that the voice of reason opposing cigarette smoking is indeed a still, small voice in a babble of advertising and social behaviour, all encouraging use of the cigarette.

Some things have been done to change this pattern. In Britain, cigarette advertising has been withdrawn from commercial television. In Italy, advertising of cigarettes has been stopped altogether. In Norway, the depiction of smoking in television programmes has been materially reduced. In the United States, television programmes that carry advertising for cigarettes have to provide opportunity for the counter arguments and a lot of useful film material has been produced there and in Canada for just that purpose.

"Tobacco is not a direct cause of lung cancer, but the habit of smoking contributes to the development of pre-cancerous conditions and subsequently of malignant tumours. Cigarettes are also an aggravating factor in cardiovascular illnesses, which are the commonest cause of death in a great many countries. To go back to lung cancer associated with the use of tobacco, we combat it in the U.S.S.R., as in other countries, with a vast propaganda campaign against cigarettes. We are also trying to eliminate other cancer-producing agents from man's environment."

NIKOLAI BLOKHIN
President of the International Union against Cancer
Director of the Moscow Institute of Experimental and Clinical Oncology
From an interview in "World Health" February-March 1970

If you feel you can't stop smoking cigarettes and want to cut down, remember it's the last third of the cigarette that does the most damage
1
2
3
1 The first few draws on a cigarette are relatively harmless since most of the tar and nicotine is absorbed by the tobacco and filter.
2 Soon, nicotine and other chemicals start to irritate and coat the delicate tubes of the lungs with an oily tar, forcing them to produce a thick phlegm. The mixture of tar and phlegm slithers deep into the lungs where it congeals and festers.
3 Tobacco smoke now being inhaled is so saturated with nicotine and chemicals that it coats lungs with more liquid tar, causes more irritation and produces more phlegm than the other two parts of the cigarette put together.

Photo WHO

Some progress has been made. At least a million fewer people are smoking in Britain; in the United States the consumption of cigarettes per head is just beginning to fall. But nothing has been achieved so far to seriously affect the mortality and morbidity statistics with which this article began. Somehow we have to do much more and, if we could get the public to realize what the benefits would be, perhaps we would get it done much sooner.

If cigarette smoking could be stopped there would be some immediate benefit for the smoker and even more for the adolescent who was prevented from starting. Cough and bronchitis would certainly be reduced. The occurrence of coronary thrombosis in middle age, and especially sudden death in young men from this cause would begin to go down and the patient who already had bronchitis would cease to deteriorate so rapidly.

Even the risk of lung cancer would begin to fall away. The man who has been smoking for twenty years is already at substantially greater risk of lung cancer than his contemporary who hasn't but, as soon as he stops smoking, that risk ceases to rise with age as it would otherwise do. If he maintains his resolution not to smoke, in perhaps twenty years or at most twenty-five he will be at no greater risk than his non smoking contemporary.

Cigarette smoking is responsible for about a tenth of all deaths in Britain each year. If everyone stopped cigarette smoking they would still have to die sometime, but the chance that death would be premature would be much less and sickness absence from work might come down by as much as a fifth.

There is no other single avoidable cause of so much premature death and disability in Britain today as the smoking of cigarettes. There is no greater benefit that could be conferred on the health of its people than the abolition of cigarette smoking and that must be true of every other country with as long and as heavy a history of using the cigarette. ■

XUM

Photo APN

Anti-smoking campaigns are increasing in intensity in many countries. In the U.S.S.R. dramatic posters, right, remind the public of the dangers of smoking, and in Soviet laboratories rabbits trained to smoke provide research workers with valuable information. Restrictions on advertising of cigarettes are in force in Czechoslovakia, Denmark, England, France, Ireland, Italy, Norway, Sweden and Switzerland. In the United States, the Senate has approved a law banning cigarette advertising on radio and television from January 1971. Great Britain's biggest ever anti-smoking campaign via the press, films and television has just been launched by the Health Education Council. Private organizations such as "Smokers Anonymous" and "Smokestoppers Ltd" provide help for those trying to break the habit. But a wide gap still exists between the vast sums spent on tobacco advertising and funds available to the anti-smoking movement. Poster in Russian reads: "How you burn up your health."

The case against smoking

by Robert M. Taylor

TWO years ago, at the opening of the World Conference on Smoking and Health in New York City, the former Surgeon-General of the United States Public Health Service, Dr. Luther Terry, set the scene by saying "We have come to the end of one era in the smoking and health field. The period of uncertainty is over. While science will continue to probe the reason why, there is no longer any doubt that cigarette smoking is a direct threat to the user's health."

If this statement was true in 1967, how much more obviously is it true today. On all sides, the evidence accumulates which points to the smoking of cigarettes as one of the greatest of health problems: the risks of developing cancers of the lung, mouth and larynx and oesophagus are greater in those who smoke; death and disability resulting from chronic bronchitis, pulmonary emphysema and from coronary artery disease lie in wait for the nicotine addict.

In Canada, a country with a population of 20,000,000, it has been estimated that there are almost 18,000 excess deaths each year caused by lung cancer, heart disease and chronic chest disease.

The statistics describing the toll due to smoking have been used in an arresting fashion by Cuyler Hammond who has estimated that while 78 per cent of non-smoking males age 25 will live to the age of 65 or greater, this proportion drops to 54 per cent for those who smoke 40 or more cigarettes per day.

Another result is that for the first time in this century... the life

---

ROBERT M. TAYLOR *is Secretary-General of the International Union Against Cancer. He is Executive Director of the National Cancer Institute of Canada and Executive Vice-President of the Canadian Cancer Society, Toronto. His main field of interest is cancer control.*

XUM

Photo WHO

expectancy of the male population is decreasing rather than increasing.

The public has heard about the hazards associated with smoking. In a poll of public opinion about cancer which was carried out in 1967 among Canadian men, it was found that 82 per cent of non-smokers and 73 per cent of smokers thought smoking was injurious to health. In the face of this knowledge, how is it that the consumption of cigarettes has not fallen.

There are many answers to this question. The first is that the tobacco industry has employed and is continuing to employ every possible means to cast doubt on the evidence which has incriminated its product. It goes even farther by denying that any hazard exists, and it is backing its position with an advertising campaign which in the Western World counts for an annual expenditure of hundreds of millions of dollars.

But this is not all. As handmaidens to the industry are the fatalism of the addict, the apathy of the public and too often the indifference or hostility of responsible members of governments who are reluctant to face the loss of income from the tax on the sale of tobacco and especially cigarettes, an income which comprises a significant portion of the total.

So those who would seek to counter these forces face great obstacles and must be prepared to fight a long battle; and we must be patient as well as persistent for it will not be in our interest to enter this controversy unless we are resolved to use our intelligence and to keep our emotions in check no matter how great the temptation to let them go.

An outstanding educationist in referring to controversy has said that controversy is to be carefully distinguished from the bilious invective or the crude personalities to which the term is erroneously applied. Anger produces little except vituperation and bombast but controversy can be sharp and pointed; it demands toughness and resilience of mind.

How should this toughness and resilience of mind be applied? I should point out that what I am about to recommend might be described as the idealized approach, that I am perfectly well aware that in some countries one or more of these proposals have been implemented, and I am equally aware that in others some aspects of the programme may be impracticable.

Each country must decide for itself the form of approach which will be suited to deal with the problem, but those of us who are in a position to create or influence public opinion must still strive to enlist a total effort—a community-wide approach.

The first and, in my opinion, the most important requirement is that each of us accept the role of an exemplar. Unless each of us is prepared to abandon the habit of smoking we can scarcely expect results in our effort to convince others of the hazard. I make this point with all the fervour and conviction of an ex-smoker of 13 years standing.

While the need to set an example is important for all who embark on the campaign, it assumes even greater importance for those persons such as physical health educators, teachers, nurses and physicians who are assumed to be more knowledgeable about matters of health than the general public.

I confess to you that it is difficult for me to understand how the prospects for cancer control can be discussed in an effective way through a cloud of cigarette smoke, and I doubt that the vision of the future can be seen under such circumstances. The smoke gets in your eyes!

The most important activities of those who would give battle to this hazard can be grouped under the

CONTINUED NEXT PAGE

XUM

It's never too late to quit!

heading of education. There has been much speculation as to whether it is more important to educate the adults or the children. Those who favour the approach to adults claim that unless one persuades them to give up smoking, the programme directed to the children will fail, and those whose targets are the children, claim that we must tackle the habit at the age when it is first taken up.

The truth is that the programme must be aimed at the members of both groups. With films and filmstrips, health talks and posters the young must be persuaded that they should not take up the habit, that it is no longer the smart thing, that it is not a sign of maturity.

At the same time, we must deliver the message to the adults and we must be prepared to back this up with offers of help in the form of withdrawal clinics for those who, having decided to give up the habit, need help and encouragement.

Perhaps one of the most telling arguments that one can use with parents is to point out that the children of parents who smoke are more likely to take up the habit, that the habit of smoking reduces the life expectancy by about 8 years and that therefore the adults who are parents and who continue to smoke are threatening their own children with the reduction of life expectancy.

I would like to make four suggestions about the features of the education programme. These may be described as the four "e's": encouragement, enlargement, enlistment and evaluation. Since these are earnest suggestions, I should perhaps refer to them as the four entreaties.

By encouragement, I mean that in our approach to adults, we should underline the benefits that can result from giving up smoking, and we should promote the idea that it is never too late to quit. I fear that in our enthusiasm to persuade, we have too often yielded to the temptation of depicting the evil results of smoking and of doing so in such a fashion as to arouse fear.

It has been shown by a number of authorities, and has been re-emphasized more recently by John Wakefield, chairman of the Committee on Public Education of the International Union Against Cancer, that fear is not the most effective means of changing behaviour. To quote J.A.C. Brown, "the more frightened people become of the consequences of an action, the more they may be impelled to continue it."

By enlargement, I mean that we should incorporate in our educational approach the point of view, that although we are concerned with smoking primarily because it is a source of cancer, it is a cause of death and disability and human misery in a number of other ways. The problem of smoking has many facets and demands a multi-faceted approach.

It is because of this fact that I use the term enlistment, and by this I refer to the importance of enlisting the co-operation and activities of other agencies both governmental and non-governmental. The best illustration of this form of activity with which I am familiar is the National Interagency Council on Smoking and Health in the United States.

Although I am less familiar with others, it appears to me that equivalent action has been taken in a number of countries in different ways. To name only two, I understand that in Austria, the Federal Ministry for Social Administration is assisted in programmes about smoking by other ministries and by such voluntary agencies as the Austrian Cancer Society; and that in Denmark, the Minister of the Interior has appointed a commission, known locally as the Cigarette Commission, representative of government and voluntary agencies including the Danish Cancer Society.

I suggest that in those countries where such collaboration does not exist, the cancer agencies take the initiative in bringing this about.

And the final "e" is evaluation. Too often the wrong, or at least the less important, statistics are used in describing an educational programme. These are the numbers of lectures and radio talks, the numbers of films and filmstrips distributed, the numbers of pamphlets produced and so forth.

WHAT is important and what should be done if we hope to make significant progress is to determine what was accomplished by the effort and this means that we must have a clear definition of the objective. Was it to inform or was it to change behaviour, or both?

To measure what was accomplished, it is necessary to carry out periodic surveys of the target population and one must ask the right questions. Let me assure those that have not yet participated in such analyses that they will be in for some surprises.

That film which you thought was superb may turn out to have had the opposite effect to that which was intended. That pamphlet which set out the dangers so clearly may have been more effective in arousing fear than in causing changes of behaviour.

And now, finally, what about the tobacco industry and its activities? It may be assumed that the industry will never institute meaningful controls of the hazards of smoking and will never initiate action to reduce the number of those who smoke.

It may be assumed that the industry is in fact contemptuous of the public and that its actions now and in the future will be motivated only by the search for profit. Under these circumstances, the cancer control agencies have important roles to play in arousing public interest in control measures.

The first target must be the advertising campaign. Mr. Emerson Foote, formerly a senior member of the advertising world and a past chairman of the National Interagency Council on Smoking and Health, once wrote a letter to the late Robert F. Kennedy in which he said, "Television advertising encourages people to smoke cigarettes. Cigarettes kill people. It is not morally justifiable to encourage people to kill themselves. Therefore, cigarette advertising on television should be banned."

In a similar but less dramatic vein, the Task Force for Smoking and Health in the United States has said "the Task Force is unable to see how in the long run a product involving the health hazards of cigarettes can continue to be advertised."

I subscribe to the points of view expressed in these statements. The fact that significant steps have been taken against the advertising of tobacco in Czechoslovakia, Denmark, England, France, Ireland, Italy, Norway, Sweden and Switzerland should give heart to the rest of us.

A desirable adjunct to controls on advertising is the labelling of cigarette packages with a clear warning about health hazards.

An ironic situation which exists in Canada and which may also exist elsewhere is that the Federal Government which is collecting $350,000,000 in taxes on tobacco and spending less than $350,000 per year on programmes directed against smoking has provided millions of dollars in subsidies to the tobacco-growing industry. The Canadian Cancer Society is joining with other agencies in an effort to bring this support to a conclusion.

Other steps which are desirable and which are being taken to reduce the hazards of smoking include restrictions on the sale of cigarettes to children and the banning of smoking in public places and in places of work.

I would like to conclude on a note of hope. I feel that the climate of public opinion is changing, that the demand for more positive action on the part of government is growing, that the social acceptability of cigarette smoking is diminishing and that the idea is taking shape in the minds of more and more persons that it is not necessary to smoke to appear grown up, and that it is necessary not to smoke to remain healthy. ■

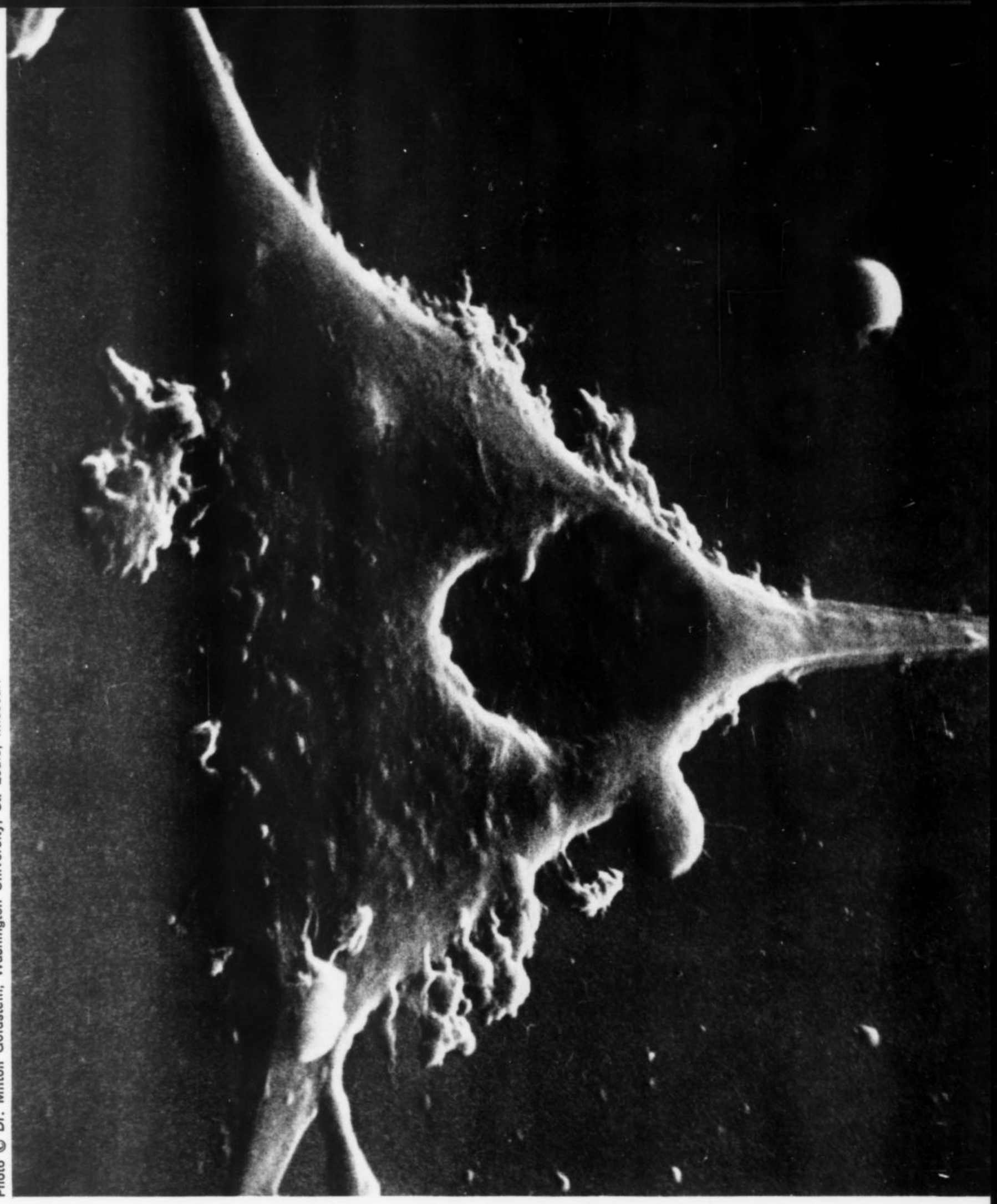


Photo © Dr. Milton Goldstein, Washington University, St. Louis, Missouri

Cancer proliferates rapidly from a tiny cell into a spreading cluster of cells or tumour. Research on human cells grown outside the body in bottles is thus a vital factor in cancer research. Powerful and versatile microscope cameras enable investigators to observe and record behaviour of cells as they multiply. Here, two cancerous nerve cells adhere to one another. Cancerous cells shown here send out threadlike bridges called "neurites" when they come in contact. Photo, which magnifies cells 6,500 times, was taken with a stereo-scan electron microscope (see photo caption page 19).

Probing the secret of the cell

C

by Nicolas Odartchenko

NICOLAS ODARTCHENKO, *of France, is director of the Department of Cell Biology at the Swiss Institute of Experimental Research on Cancer, Lausanne. In 1969 he was awarded the Prix Suisse du Cancer for his research. Dr Odartchenko is a member of the Faculty at Lausanne University.*

ANCER research extends over a much wider field than most people realize. What science learns about cancer may come from clinical data in medicine and surgery or in more highly specialized fields. It may be based on studies of disease and population. And, clearly, it may come from experimental research in which the most recent and the most varied branches of science are represented.

Basic research into cancer has indeed become a speciality in its own right, and the principal task of those engaged in it is to decide what are the vital questions to be answered. But these questions are so numerous and varied that practically all the new technological discoveries that apply to biology are in fact also applicable to experimental cancer research.

The specialist in a modern, well-

CONTINUED PAGE 20

XUM

Photos © Professor Georges Barski, Institut Gustave Roussy, Villejuif, France.

Every minute about 3,000 million cells in the body die and are replaced by new ones. A remarkable feature of normal cells is their orderly growth—they "know" when to stop reproducing. Malignant cells, however, continue to multiply unrestrictedly, invading and destroying adjacent normal cells. Above left, normal embryonic cells taken from mice and magnified 490 times. Above right, malignant cells, magnified 123 times, proliferate (top of photo) and invade the normal cells (bottom of photo). Below, detail of malignant cells shown above.

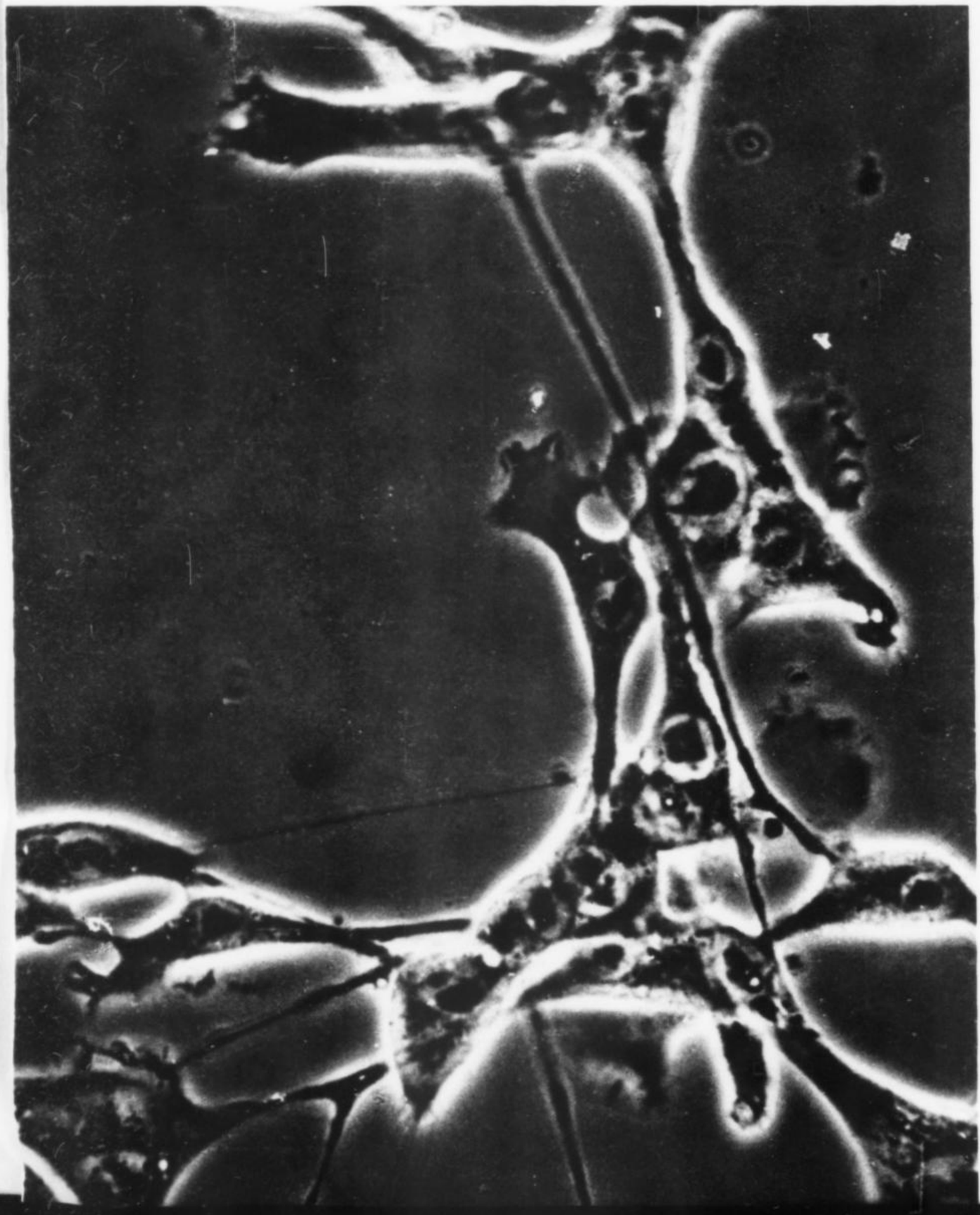
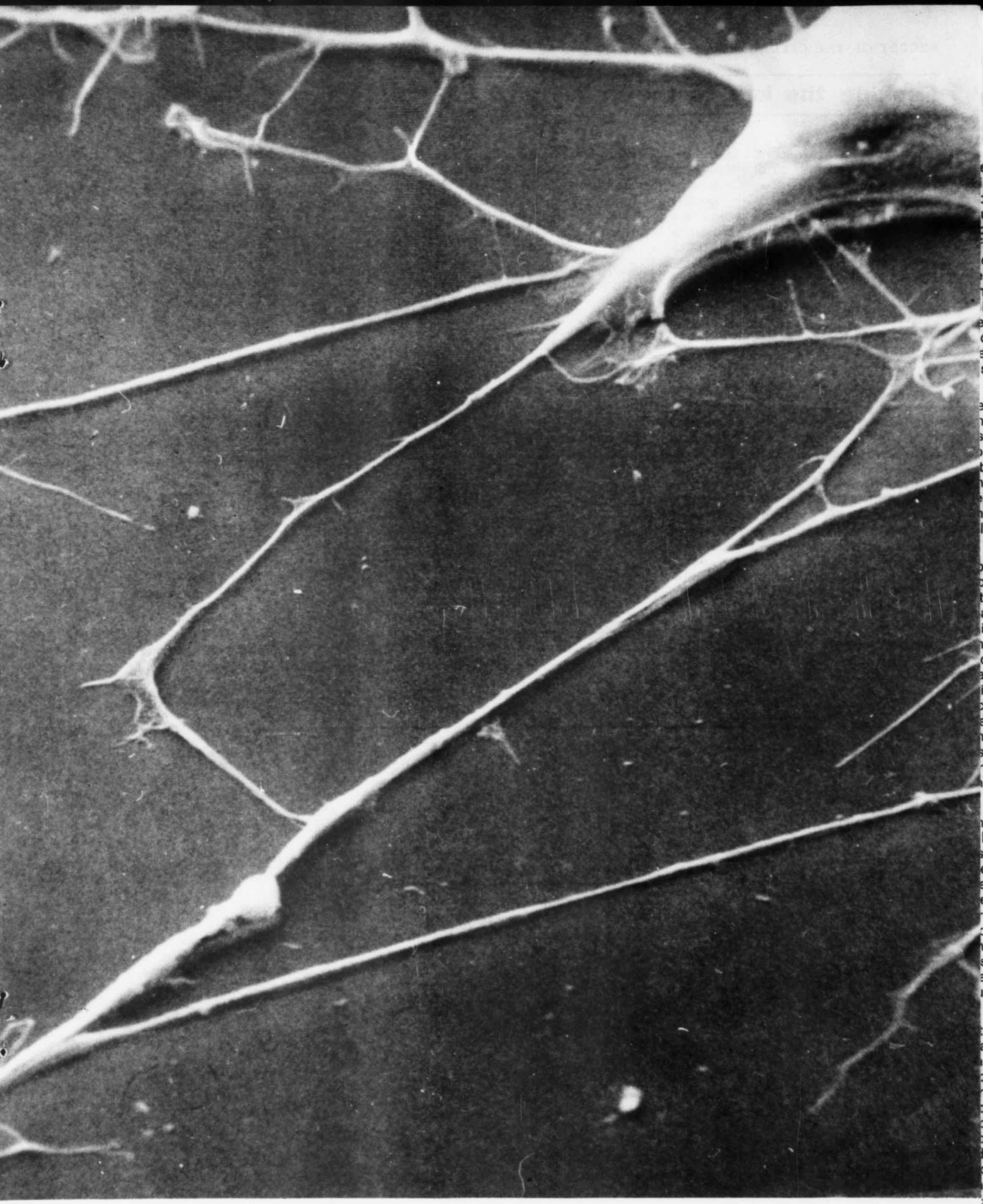


Photo © Dr. Milton Goldstein, Washington University, St-Louis, Missouri

SPREADING FIBRES
OF NERVE CELL TUM



The development a few years ago of the scanning electron microscope with its depth of focus has made it possible to obtain striking three dimensional pictures of biological surfaces. A useful magnification of up to 50,000 is obtained. Above, a stereoscan electron microscope view of cancerous nerve cells, magnified 3,000 times. These cells have been grown in tissue culture for many years. Although separated from one another, diluted and placed in new bottles, they continue to multiply and send out threadlike growths.

UMOUR

Seeking the key to the mystery of life

equipped cancer research laboratory has an impressive array of instruments and equipment to work with. In centrifuges that spin at ever greater speeds, molecules, complex and fragile, are separated from biological extracts. With automated, high precision radiation counters, researchers trace the movement of minute quantities of radioactive substances through a complex molecular maze of cells or tissues. And these are but two among a thousand other examples of the direct application of modern technology.

Machines such as these are usually run on tight schedules since there is nearly always a waiting list of would-be users, and scientists often have to wait several days before their turn comes to have access to them. Thus, any mechanical or electronic improvement that reduces the time taken by a machine to carry out a particular measurement or calculation represents very real progress indeed, and such improvements are constantly being made by the rapidly developing industries of today.

All this points not only to the fact that research in an ultra-modern laboratory is an expensive operation, but also how difficult it is to pinpoint neatly and precisely the field covered by cancer research.

The same is true of traditional disciplines such as physiology, genetics, biochemistry or pharmacology whose boundaries are now wellnigh impossible to define. Thus, the work of researchers in biology tends to be increasingly concerned with the particular level of organization in the material they study: molecules, structures forming part of the internal anatomy and physiology of the cell, membranes, isolated cells, cellular aggregates or organs, populations within the same bacterial, animal or vegetable species, and, finally, ecological systems, with regard to which one could speak of populations of populations.

Exchange of facts and findings is simplified for biologists working at a similar level of organization, whether their work is concerned with bacteria, plants, animals or man. Before even attempting to revise the classification of the traditional disciplines, the changes in the areas where fruitful dialogue is at present possible should be noted.

A brief description of one of the fundamental problems of cancerology —the reproduction mechanisms of the cells of an organism—provides an example of this overlapping between the various branches of the biological sciences. This problem of cell reproduction leads on directly to the question of the existence and nature of factors which may have a controlling function.

As is now known, the chemical substance, desoxy-ribonucleic acid (DNA) contains the code which determines the hereditary characteristics not only of the organism as a whole, but also of each of its innumerable cells. DNA is contained in the chromosomes of the cell nucleus, and according to recent scientific findings, it seems not to be subject to any type of metabolic regeneration or turnover, whereas the other types of molecules contained in a cell are constantly being replaced by new ones at speeds which may be specific for each type.

The reproduction of this "huge" molecule (which includes about 5 million elements of information in mammals) is therefore an essential preliminary to any cellular division because each cell of the organism is known to contain a constant quantity of DNA.

This idea of constancy is essential. It corresponds to the fact that the chromosome construction is practically the same for all the cells of an organism and for all the members of a given species. The number and appearance of the chromosomes defines what is called a "karyotype" which in certain cases makes it possible to identify differences between living species which would be considerably more difficult to define by other criteria.

At the molecular level, the reproduction of DNA is effected by a so-called "semi-conservative" mechanism (by the synthesis of a new element superimposed on a pre-existing one), which has been demonstrated in bacteria and, more recently, in viruses.

This method of reproduction has been established only at the chromosome level in the case of multicellular organisms. Such a mechanism explains why the distribution of DNA, in each of the two daughter-cells resulting from a division, is quantitatively and qualitatively equal (see photo page 21).

The period between two successive cellular divisions—the interphase—is therefore by no means one of "cellular inactivity". Vital processes take place: the preparation for the synthesis of DNA, the synthesis itself, that is, the reproduction of the DNA molecule, and the preparation for cellular division.

Experimental research shows that once the synthesis of DNA has begun it becomes relatively difficult to interrupt the chain of processes leading to cellular division. It is as if a critical threshold or point of no return existed, which must be located shortly before the start of the DNA synthesis.

This explains why the mechanisms which may help to trigger off the synthesis are now being studied. In the case of multicellular organisms, neither the existence nor, obviously, the nature of the precise factors involved in this sparking-off process are yet known.

Thus, it is obvious why all aspects of cellular proliferation, both in normal tissues and in malignant tumours, are now being carefully studied. We have, in fact, to find a way of determining the mechanisms which control cellular multiplication itself.

Methods available to researchers have made great progress in the last few years, although one very important factor concerning them needs to be taken into account. Broadly speaking, the simplest model, that of a system in which all the cells double in number (therefore showing an exponential increase) applies for practical purposes only to bacteria and to cells isolated from their parent organism and grown in laboratories.

The most elementary parameter that can be observed in such a system—the time required for its numerical doubling—cannot be applied to organs still functioning in the body. In their case, apart from the phenomena of growth and aging, an equilibrium in the number of cells is constantly maintained under normal circumstances, and there can be no measurable doubling time.

One classic experimental example is the regeneration of the liver after the surgical or toxic destruction of a major part of hepatic tissues. Normally the liver changes very little during adult life. The total number of hepatic cells remains approximately constant and only a few cells are replaced. Consequently, in sections of normal adult liver, one sees only one cell in around 20,000 which is in the process of dividing.

If a part of the liver, of a rat for example, is destroyed, an enormous number of cellular divisions appear, resulting in a tendency to restore the organ to something like its original volume. This wave of divisions is preceded by a wave of DNA synthesis, itself preceded by a wave of synthesis of other molecules essential to cellular function, including ribonucleic acids, enzymes and other proteins. The cellular proliferation is specific, that is to say that the cells thus produced are liver cells and not those of another organ.

On the other hand, the proliferation "knows" when to stop, which means

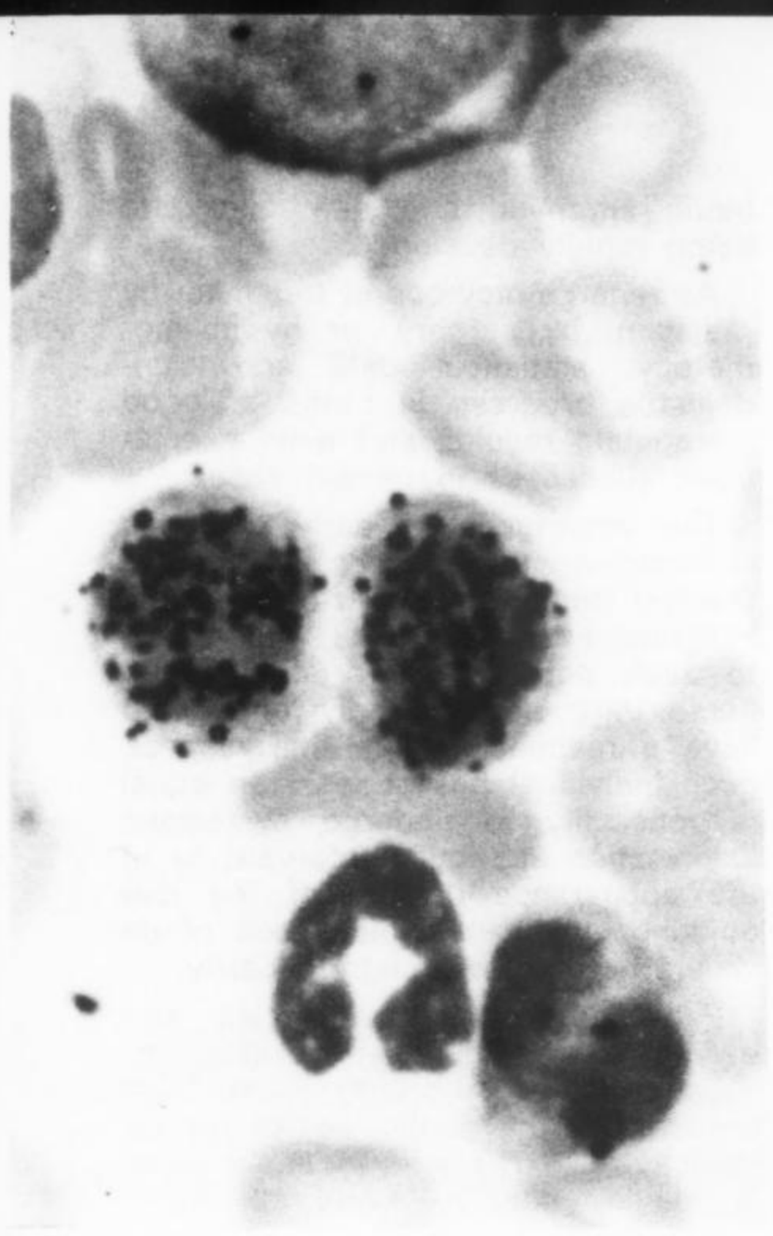


Photo © Dr N. Odartchenko, Lausanne

This photograph reveals the astounding process by which nature transmits the inherited characteristics of all living creatures from cell to cell. Here, a cell in human bone marrow has divided into two "daughter" cells, each of which has been given an identical number of molecules of DNA, the chemical substance whose code determines heredity (molecules are seen as black dots through "tagging" with a radioactive substance). Scientists are beginning to break the DNA code. A complete understanding of the nature of the code and the methods for controlling the release of information from the code will make it possible to control cancer.

that it does not go beyond certain limits. But the special point is the idea of a "decision" which initiates this cycle of cell multiplication, a "decision" the nature of which is unknown, since we do not even know whether it involves a true stimulus or the removal of an inhibition.

Here again we find the idea of initiation of the DNA synthesis referred to above, since, before the lesion, practically all the liver cells contain an amount of DNA which is the same from one cell to another and equal to the value which characterizes the cells before synthesis begins.

This process of synthesis results in an exact doubling of this quantity of DNA, because two cells have to be produced from a single cell. In this example, the different stages of the reaction to the lesion are the principal points of investigation by researchers in this field.

In addition to various increasingly refined biochemical techniques, possibilities of examining the ultra-structures at the extraordinary magnifications within the capability of modern electronic microscopes, and our growing knowledge in microbiology and virology, a new and fruitful method of investigation has, in the past few years, assisted the study of the physiology of cells grouped in the organs or tissues of multi-cellular species.

DNA, the molecule of which is doubled at the time of the synthesis which precedes a cellular division, and only then, can be tagged by a precursor which is then involved in everything which subsequently happens to the DNA molecule.

The heavy isotope of hydrogen, called tritium, can be used as a marker for this precursor. Thanks to the radiation it emits, it can be followed at the structural level of individual cells by the process of auto-radiography.

Such studies, which have been dubbed "cellular biographies", consequently allow the comparison of the mode of cell reproduction in normal tissues with that of disturbed proliferation in, for example, a malignant tumour, and will perhaps lead to the discovery of some of the causes of the breakdown of the normal equilibrium.

But this striking example should not cause us to overlook several other lines of research which are also under active development in many laboratories. Among these, the study of chromosomal abnormalities in the cells of patients with malignant diseases has not, properly speaking, shown up changes which are permanent and exclusively related to the malignancy.

There is an exception to this rule, that of chronic myeloid leukaemia in Man, in which the total number of chromosomes is normal but chromosome 21 (one of the smallest) is structurally abnormal: one of the long arms is absent (Philadelphia chromosome). We do not yet know very much about the relationships between this anomaly and the mechanisms which initiate leukaemia—in particular whether this anomaly is a predisposing factor, an effect, or a cause.

The study of metabolic anomalies in tumour cells has made much headway from the discovery of the so-called "minimal deviation" tumours, which permit the establishment of valid comparisons between normal and abnormal cells.

A special enzyme, asparagine-synthetase, which acts as a synthetizer of an amino acid, an essential component of cell physiology, may be absent from some cells of tumour origin. This discovery will perhaps lead to the development of a specific treatment by the administration of asparaginase, with the object of interfering with the supply of asparagine coming from normal cells. This procedure could then be directed towards the selective destruction of tumour cells which cannot themselves produce asparagine, one of the substances vital to them.

The changes in the cellular surfaces of cells of tumour origin are also being very actively studied. One of these changes—the loss of contact inhibition—is very important. That is to say, the normal tissues which surround the tumour cells no longer inhibit their movements, this inhibition being normally effected through simple contact.

This loss of contact inhibition is accompanied by a tendency on the part of the tumour cells to invade or infiltrate neighbouring normal tissues. The electrical charges of this membrane have been studied, but the problem has not been solved. Additional factors may intervene, as for instance the secretion of lytic enzymes, that is to say enzymes which destroy the cells, of toxins, inflammation phenomena, and finally problems related to the expansion of the mass of tumour cells, i.e. the pressure exerted by the tumour on neighbouring tissues.

The appearance of specific antigens in tumours was demonstrated as early as 1953, by the U.S. microbiologist, Edward Foley. If tumours in mice, induced by the carcinogenic chemical substance methylcholantrene, are surgically removed, the mice are found to be resistant to later grafts of the same tumour. Specific antigens have since been discovered in animals, for a large number of tumours, whether of chemical, viral, or spontaneous origin.

Attempts have been made to relate these findings to certain clinical observations, as for instance the apparently spontaneous regression of tumours; the great length of the latent period, on occasion, in the development of cancers; the regression of metastases [cancerous growths which have spread from one part of the body to another] after surgical excision of the primary tumour; and finally the fact that the majority of the cells which separate from the primary tumour disappear without giving rise to metastatic growths.

We cannot at present analyse precisely the real rôle of these immunological factors in human beings, since the experimental methods based

CONTINUED NEXT PAGE

on tissue exchanges between selected, genetically pure breeds of mice cannot be used in research on humans. But the possibilities of practical trials on Man are being studied. These would be designed to measure directly the power to destroy tumour cells possessed by the immunological defence cells responsible for this type of reaction.

This is an extremely important area of research, for the possibility of using immunological means of attack, of perhaps increasing the organism's natural defence mechanisms, is one of the great hopes of those who think that new treatment methods can be found in this direction.

The study of the rôle of viruses in the production of cancers is certainly one of the major problems of current research. Although a special form of malignant disease—fowl leukosis—has been attributed to viral infection for more than fifty years, it is only in recent years that the major development of virological research on cancer has occurred.

A number of cancers in a wide variety of animal species are today recognized as clearly attributable to viruses. The properties of the viruses in question and their possible mode of action are being very intensively studied.

In fact, while it may not be possible at present to give a precise reply to the question "Are human cancers caused by viruses?," animal experimentation is continually providing data which will give us a clearer conception of the mode of interaction between the genetic material of the virus and that of the cell or cells infected by it.

Two stages need to be distinguished in viral infection. As defined by André Lwoff, Nobel Prize-winner for Biology in 1965, they are the introduction of genetic material inside a cell—the entry proper, governed by surface phenomena, the envelope of the virus, the surface of the cell—and the consequences of the presence of the virus inside the cell, which bring different processes into play.

These consequences are therefore at present being analysed in the light of the most significant biological concepts recently acquired, i.e. the mechanisms by which living matter preserves a genetic memory, how this is transmitted to the cells resulting from a cellular division, and how finally the information is transmitted to the cell as a whole and translated to play its part in a specific function.

In addition, the problems of virology and those of immunology are related, more particularly through the common hope of developing means of treatment by immunotherapy. In this connexion, the discovery of a new type of tumour —Burkitt's tumour—which is a special type of malignant tumour of the jaw found in children in tropical Africa, goes back only a few years and a number of arguments suggest a viral origin.

The relationships observed between immunity to a herpes-type virus and the incidence of these Burkitt's tumours and even certain cancers of the naso-pharynx may perhaps open up new approaches to this important question.

The above are a number of examples of focal points of current cancer research. They represent merely an arbitrary choice from among a great many others, but the important lesson to be learnt is that, as far as each of these examples, and indeed our overall understanding of the problem, is concerned, our basic knowledge has not as yet given us a general key such as other branches of science possess.

This means, on the one hand, that basic research should be still more actively pursued in an attempt to find what we may justifiably imagine to be such a key; on the other, that current methods of treating malignant diseases in human beings, are inevitably affected from the outset, by the consequences of this imperfection of our basic knowledge.

This does not by any means imply that present-day methods of treatment are ineffective. On the contrary, all the well-tried methods are continually being improved and new ones are being rapidly developed.

As regards methods of treatment by radiation, by surgery, or by chemotherapy, statistical data show undeniable progress in terms of good therapeutic results, and even spectacular successes in certain cases.

The importance of early detection in improving the chances of effective therapy cannot be over-emphasized. Progress has been made with regard to such detection, but doctors and nurses are not the only ones who have a responsibility in this respect. Each individual has at least an equal responsibility to undergo systematic examination at regular intervals, or at the appearance of any of the disquieting symptoms which each of us should be able to recognize easily.

Public authorities have a clear and even over-riding responsibility to make facilities for proper examination available to the public, i.e. to set up detection centres and to equip them completely for this kind of work.

These considerations are equally valid for a final but essential problem: cancer prevention. In this area, mass measures are likely to prove not only the most effective, but also the most urgent.

Artificial food additives, indeed the whole food supply, should be supervised and measures taken to reduce tobacco consumption. Steps to reduce pollution of the human environment, particularly by chemical or radioactive substances, should also be given priority. ■

Chromosomes, the structures contained within the nucleus of every living cell by which genetic information is transmitted, are currently the subject of intense research. Observation of cells taken from a leukaemia patient reveals the presence of an abnormal chromosome. Right, photographs of chromosomes, taken by an electronic microscope, are cut out and assembled in pairs for comparison. Below arrowed, an abnormal chromosome from a patient suffering from chronic myeloid leukaemia. Most of the long "arm" of the chromosome is missing.

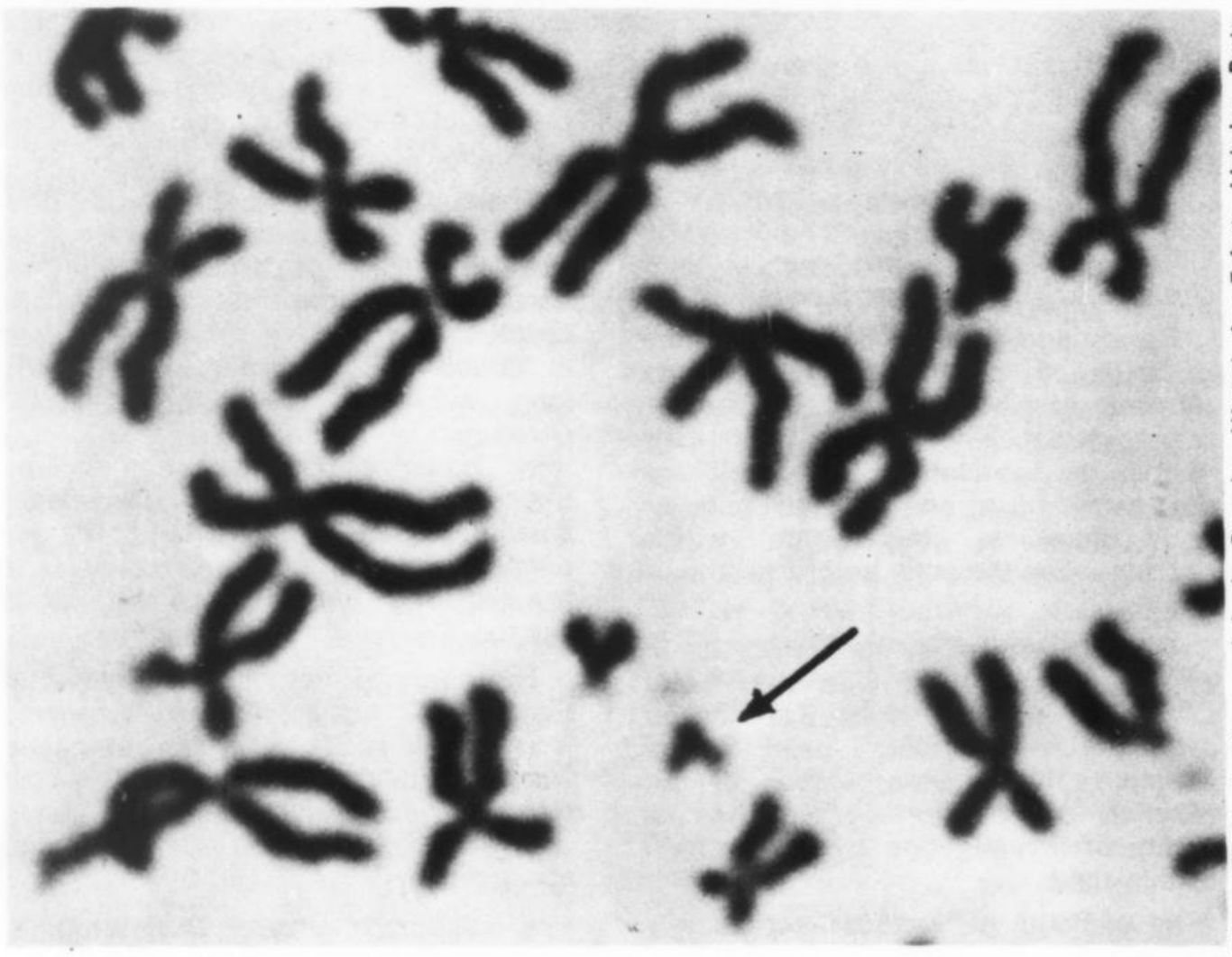


Photo © C. de Nova and J. de Grouchy, Hôpital des Enfants Malades, Paris

A false notion cancer = incurable

by Eric C. Easson

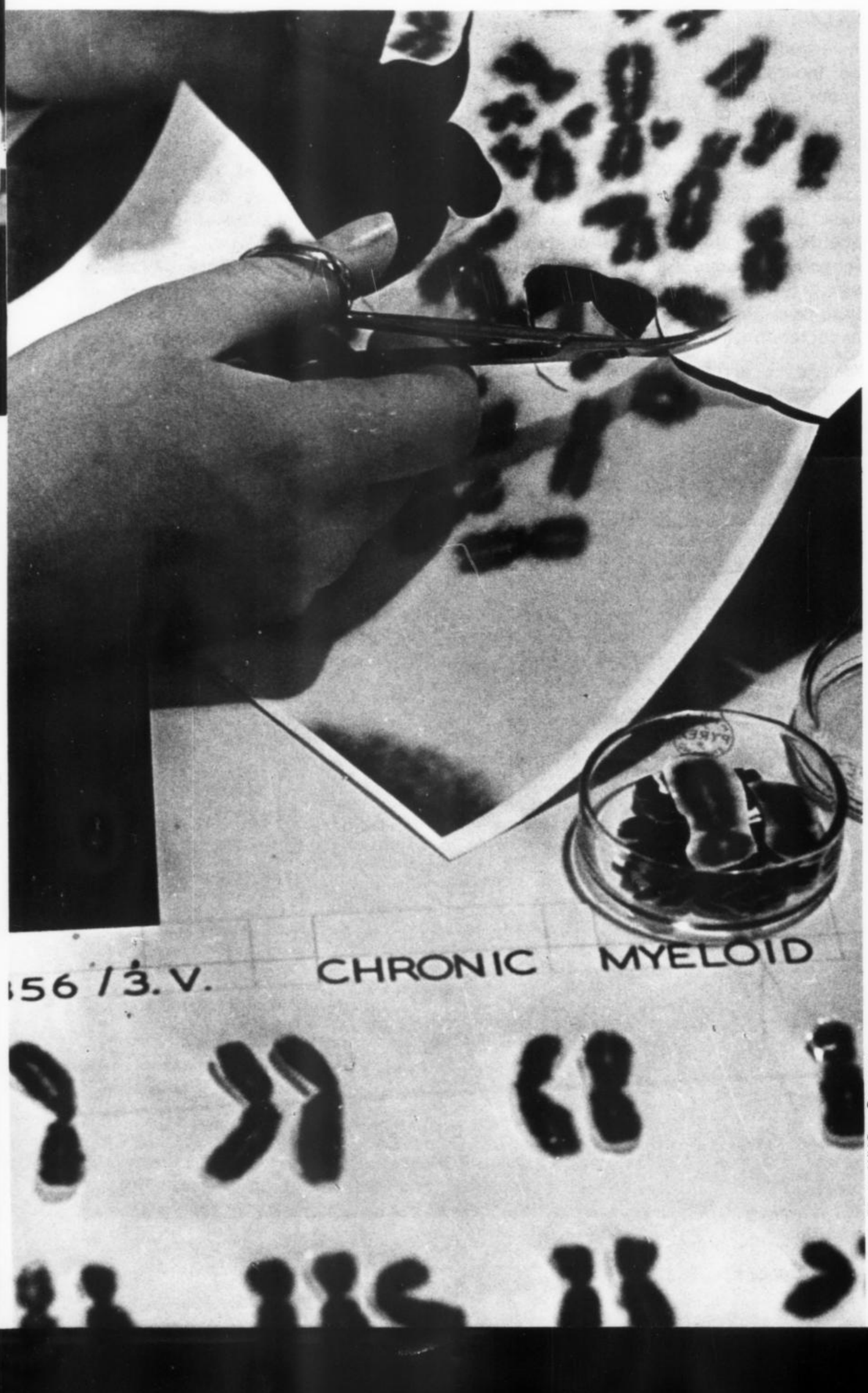


Photo WHO - Spooner

THOSE of us who are concerned every day with the clinical care of patients with cancer are often asked why we are so obsessed with early diagnosis. The reason is that every day of every week we are faced with the patient whose malignant tumour is no longer amenable to curative treatment, though that same patient could have been cured by readily available and well-tested methods of treatment if only he had reached hospital when the tumour was less extensive.

Commonly accepted five-year survival rates following appropriate treatment for a number of common cancers show that the early localized tumour is readily controllable, but when the cancer has become more extensive cure is virtually impossible.

In the field of tumour pathology it is axiomatic that with the passage of time a malignant tumour grows larger. It is equally axiomatic that the risk of widespread metastasis [the establishment of secondary tumours in other parts of the body] also increases with the passage of time.

Though it is undoubtedly true that a very small proportion of tumours have a capacity for widespread metastasis whilst the primary tumour still remains relatively small, in the majority of cases this prognostically unfavourable situation is a late development in the natural history of the tumour.

The very wide difference in the response to treatment is such that even a modest reduction in the time-interval between the patient's first symptom and effective treatment could not fail to create substantially better

CONTINUED NEXT PAGE

ERIC EASSON *is Director of Radiotherapy at the Christie Hospital and Holt Radium Institute, Manchester, England. An internationally recognized authority in his field, he is Chairman of the Commission on Cancer Control of the International Union Against Cancer.*

Early detection saves lives

five-year survival rates. Indeed, a modest shortening of this delay period and consequently diminished extent of disease would doubtless save more lives, more quickly, than any foreseeable advances in fundamental research.

Nevertheless, there are still those who adopt the attitude that cancer is inevitably fatal and that earlier treatment only increases the time interval between death and the date of treatment. Though it may have been difficult to refute this plausible armchair philosophy when the only yardstick of treatment was the five-year or ten-year survival rate, it is now possible to define cure in statistically valid terms. We can speak of cure of cancer when, some years after treatment, there remains a group of patients whose annual death rate from all causes is similar to that of a normal population group of the same sex and age distribution.

In the case of cancer of the larynx, at about four years after treatment (in this case by X-Rays) the two survival curves begin to run parallel to one another. In other words, from about the fourth after-treatment year the surviving cancer patients are dying of the same general causes and at the same rate as members of the general population around them of the same sex and age. Today we can claim that for early cancer of the larynx some 80 per cent are entirely curable.

As a second example—cancer of the uterine cervix—the survival curve for cancer patients begins to run parallel to that of the normal population (in this case, of course, all women) about six years after treatment. Cure for early cervical cancer today can be expected in some 75 per cent of patients.

Even with Hodgkin's disease [in which the lymph glands become enlarged], for many decades regarded as incurable, we can now see that under favourable circumstances more than 40 per cent are alive and well ten years after treatment with a calculably normal expectation of life.

Cancer of the breast has been described as incurable by a number of sceptics over the years and again only recently in some British medical journals. Survival curves, however, show that from the 12th year onwards the expectation of life of a woman treated for early breast cancer is identical to that of a normal woman of the same age. The definitive cure rate for this series of patients with localised breast cancer is, in fact, 52 per cent.

Some of the patients in this series, however, had substantial tumours measuring 5 to 10 cms in diameter though still conforming to our definition of stage I cancer. Considerable improvement in this situation should therefore not be difficult and tumours of more modest dimensions might well be as curable as cervical or laryngeal cancers. Curability—not simple survival—is influenced by the extent of the tumour at the time of treatment. In short, time is the vital factor in curability.

It is fair to ask, however, whether early diagnosis is possible with all types of malignant tumours. The short answer to this is "No."

Where the site of the tumour is favourable—including those to which I have already referred—early diagnosis is undoubtedly possible, because of a palpable lump, visible ulceration, or some clamant symptom such as hoarseness in laryngeal cancers or bleeding with cancer of the uterine

1,500,000 AMERICANS CURED OF CANCER

There are more than 20,000,000 ex-smokers in the United States today. Among these are 100,000 physicians, or half of all members of the medical profession in the U.S.A. who ever smoked cigarettes.

Uterine cancer was once the leading cancer killer of American women. In 1935, the death rate per 100,000 women was 26.8; as a result of unremitting educational efforts and great improvements in detection and treatment it is now down to about 11 per 100,000.

Both these achievements are in large part due to the efforts of the American Cancer Society. Yet when it was founded in 1913, under its earlier name of the American Society for the Control of Cancer, by a group of 10 physicians and 5 laymen, for the purpose of "educating the public at large in the absolute necessity of treatment at the first sign of cancerous growth," the word "cancer" had roughly the same social acceptance as the word "syphilis." Mention of cancer in polite society was taboo.

The Society's initial aim, therefore, was to inform both doctors and the lay public. Doctors themselves were sceptical about any possibility of curing the disease and the general public viewed it through a cloud of superstitious fear rooted in ignorance.

For some 30 years the education of both doctors and the general public remained the essential goal of the Society. In 1945, the Society was reorganized. It became The American Cancer Society and instituted a national research programme, in which it had invested more than $200,000,000 up to 1968, whilst retaining its educational function.

The Society also broadened the range of its volunteer activity. Half the National Board of Directors are now laymen and more than 3,000 local Cancer Society Units have been established throughout the United States.

A broad communications approach is adopted to motivate a population of over 200,000,000. It tries to reach people where they live or work, where they study, worship or relax, when they read newspapers, watch television, listen to radio or go to meetings. It devotes much energy to encouraging an immediate person-to-person approach; the advice of a friend or acquaintance can play a vital role.

This approach is essentially optimistic and the message of hope is bolstered by statistics. The use of factual stories of cured patients has been an important element. Cured Cancer Congresses make real the existence of more than 1,500,000 Americans who once had the disease and are cured.

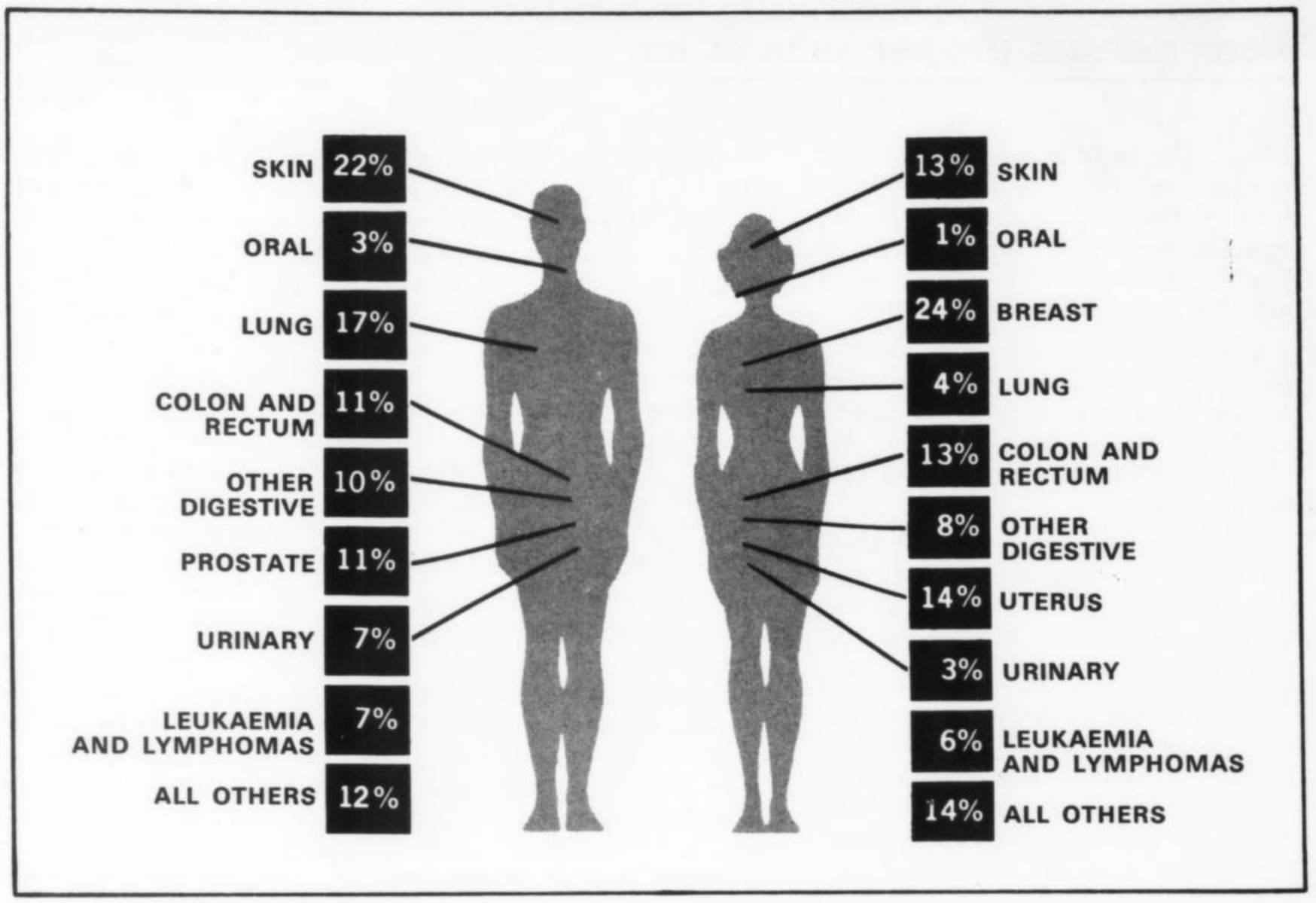
At the same time the Society enlists the support of all physicians and helps them to keep their knowledge of cancer up to date. Medical policies are candidly discussed and debated at professional meetings sponsored by the Society and there is a continuous effort to bring the latest therapeutic advances to the attention of doctors.

The Society's 2,300,000 volunteers have a number of specific achievements to their credit. For example, 68,000 volunteers provided the manpower for a massive public health survey in which over a million adults' medical histories were followed over a period of 6 years. In 1969, volunteers raised over $50,000,000 for the Society. Largely due to their propaganda campaigns about two-thirds of American women over 21 have taken the "Pap" test for cervical cancer at least once.

Progress against cancer has been slow but sure. In 1937, the cure rate of cancer in the United States was one in five cases; today it is one in three. This is the result of many factors, but not the least is that the great majority of Americans are now aware that, with treatment, the disease is curable and take steps to protect themselves and their families. ■

XUM

Cancer is not one disease but a family of diseases the incidence of which varies from one region to another. Right, a breakdown of the various types of cancer in men and women in the United States drawn up by the American Cancer Society. It is noticeable that the incidence of lung cancer is much higher in men than in women. A WHO committee of experts recently stated that more than 50 per cent of all cancer patients could be cured if the disease were diagnosed in its earlier stages and that, in many countries, three out of four cancers occur in parts of the body that are easily accessible for diagnosis and treatment.



Drawing : American Cancer Society

cervix or the bladder. On the other hand, early diagnosis of malignant tumours in such sites as the lung, the brain, the pancreas, the liver, etc., is only very rarely realized. By the time these tumours declare themselves clinically they are too often beyond cure. How to improve this situation is one of the pressing problems for cancer research.

How can earlier diagnosis be achieved? Efforts are needed in three general fields: firstly, public education; secondly, professional education ; and thirdly, the need to concentrate on high risk groups.

Public education on cancer is not a field for well-meaning amateurs. In a study of patients' reasons for delay, carried out in Manchester, England, some 15 years ago, it became clear that a patient with a lump in the breast was more likely to suspect cancer (and 72 per cent did so) than patients with other symptoms which were not associated in the patient's mind with a potentially malignant cause (23 per cent of cervix cancers and 15 per cent of cancers of the mouth or skin).

Patients with troublesome bleeding from the womb or an ulcer of the mouth or skin tend to seek early advice because of the nuisance of the symptoms. The patient with a lump in the breast, on the other hand, procrastinates in spite of her suspicions.

This delay is largely an expression of fear coupled with a deep conviction that, if cancer is diagnosed, no effective treatment is possible. This pessimism leads to delay and delay leads to extension of the tumour with, as we have seen, a rapidly worsening prognosis.

This finding might lead to the erroneous idea that to publicize, for example, what have been called the "Seven Danger Signals of Cancer," might lead to more delay and not less. The important lesson learned here was that an essential ingredient of any public education programme must be an improvement of the image of cancer and the dissemination of optimistic attitudes to this disease. The public at large must be given encouraging information as to the prospects of cure.

There is no need for me to go into details on how best to educate the public about cancer, but clearly there are some very wrong ways to go about it. The International Union against Cancer (U.I.C.C.) has established a Committee on Public Education (under the chairmanship of John Wakefield) which for many years has been concerned with the subtleties and problems of education and has published many reports on psychological, socio-economic and methodological research in this field.

What, it may be asked, is the probable outcome of a consultation between a pessimistic patient and an equally pessimistic physician? Experience and carefully designed investigations have shown, unhappily, that there is a very considerable degree of pessimism about malignant disease within the medical profession itself. I have already mentioned the attitude of some workers in this field who have continued to express the view that malignant disease is inevitably fatal. Hodgkin's disease was long regarded as fatal without any adequate evidence to support this pessimistic view.

Too many radiotherapists—my own field of work—seem to regard radiation therapy as serving only a palliative function in the management of patients with malignant disease. Curative treatment is regarded by many throughout the world as a faint possibility at best.

Pessimism within the nursing profession is no less than in the medical profession and, indeed, doctors and nurses on the whole are probably almost as pessimistic about cancer as the general public. To try to correct this unawareness of the favourable aspects of malignant disease the U.I.C.C. has a committee concerned with Professional Education, under the chairmanship of Professor Umberto Veronesi.

In certain industrial processes, groups of workers are know to have been exposed to carcinogens of one kind or another and are properly described as high risk groups. Another typical high risk group are heavy cigarette smokers who have a much higher than normal risk of developing cancer of the lung.

A high risk group may be confined tc one specific socio-economic group of a community, and certain national groups seem likewise to carry special

CONTINUED NEXT PAGE

Fear versus proper education

risks. The need to identify high risk groups in any population arises from (1) the need for earlier diagnosis, and (2) the limitations of the rather coarse physical methods so far available for achieving earlier diagnosis.

It is important to distinguish between early diagnosis, on the one hand, and, on the other, a screening programme to detect pre-cancerous lesions the removal of which achieves true cancer prevention.

Where earlier diagnosis of established cancer is required we are concerned (a) with symptoms and (b) with physical examination of one kind or another.

When we are concerned with a common cancer, such as a breast cancer in England or gastric cancer in Japan, we begin to think in terms of some physical means of detection on a population basis.

So far as breast cancer is concerned we have already seen that cure is possible by correct methods of treatment, but that much higher cure rates are achieved with smaller tumours. How feasible are screening programmes for the detection of small tumours?

Some workers urge regular self-examination of the breasts. This is at least inexpensive and requires no help from others apart from initial instruction. But is it effective? Can one really expect a widely acceptable programme of self-examination to produce a demonstrable impact on breast cancer death rates? Personally I am sceptical.

But what of other physical screening methods such as mammography (X-Ray examination), thermography and ultrasonic scanning? These three methods are under careful study in a number of reliable centres and we await, with impatient interest, the outcome of the final analyses.

But even if they prove potentially effective can these techniques be applied to whole communities often enough to create the impact we require on the breast cancer problem? What of the economics of such a programme, not only in terms of cost to the patient, but in terms of manpower to carry out the examinations and, equally vital, to maintain clinical records and follow-up?

Here then is where it might be essential to concentrate on the relevant high risk groups. But do we know the high risk groups so far as breast cancer is concerned? A lot is indeed known about this. Nevertheless, breast cancer detection programmes will have to be very carefully designed if they are to show any success.

What of gastric cancer? In Japan, where this is the commonest of all malignant tumours, great efforts are being made to carry out fibre-optic gastric photography on a large scale. But again we are faced with the economics of the problem, in the widest sense of the term. Once more the need must surely be to determine the truly high risk group and to concentrate first on that section of the population.

In the United States a yearly examination of the intestines is recommended in the hope of detecting either pre-cancerous or early malignant lesions. So far as I can judge, however, this is an expensive procedure and, if widely based population screening is to be done, some economic direction of effort is essential.

In short, every country and indeed every region and socio-economic group within each country has its own high risk groups who represent the primary problem in cancer control. Each country must therefore work out its own approach to its own problem.

The U.I.C.C. has a special Commission concerned with Cancer Epidemiology under the chairmanship of John Higginson. This Commission has already carried out extremely important work in mapping out the sometimes wide variations in cancer incidence throughout the world. This is one of the first steps in establishing the existence of high risk groups, providing guide-lines for national cancer control programmes.

RESEARCH is a much abused word. To many people research means test tubes, guinea pigs and mice, and some organizations will only finance this type of research. In fact the U.I.C.C. Committee on Public Education is vitally concerned with research in educational methodology and the evaluation of different techniques of persuasion. The Committee on Professional Education is likewise concerned with educational psychology and techniques. The problem of how to combat pessimism on the one hand and how to translate knowledge into action on the other, are very considerable problems indeed.

Epidemiological studies are vital to the identification of high risk groups, and research must further be carried out into different techniques for the detection of early cancers in all anatomical sites.

I have already mentioned a number of sites in which early detection is rarely achieved and new techniques for preventing and or detecting cancer in these sites must be sought with a proper sense of urgency. At this point we begin to look to those concerned with fundamental research in cancer in the hope that some test, similar perhaps to the Wasserman test for syphilis, or other serological tests for various infections might yet be applied to the field of malignant disease.

Even if it should ultimately prove possible, it would, of course, be of little value to present the clinician with a test indicating only that cancer exists somewhere in the body. What we require is some specific test which indicates the probable presence of cancer at some specific anatomical site. Such a test, I fear, seems a very long way from realization.

To sum up, we must continue to accept the challenge of cancer as it is today. We must not be dismayed by our present failures; failure to cure attracts attention—success goes unnoticed.

We must increase our already considerable successes for all those cancers for which current therapeutic measures can already offer high prospects of permanent cure provided we can get them to hospital earlier than we do at present.

The percentage of early stage cancers of the uterine cervix diagnosed have increased about 15 per cent over the past four decades in my own centre. It would be nice to explain this on the basis of public education and/or on cervical cytology. It is not, unfortunately, possible to attribute this improvement to any one activity and it seems to me most likely that it is the result both of local and national changes in the climate of opinion concerning cancer in general and cervical cancer in particular. Whatever the reason, this change must undoubtedly lead to the saving of many many more lives. This kind of improvement in prognosis must be sought with cancers in all anatomical sites and by all available methods.

The International Union against Cancer is already active in all the relevant fields of work and, with continued international support, we can confidently expect each type of cancer, one by one, to yield to increasing therapeutic pressures. ■

XUM

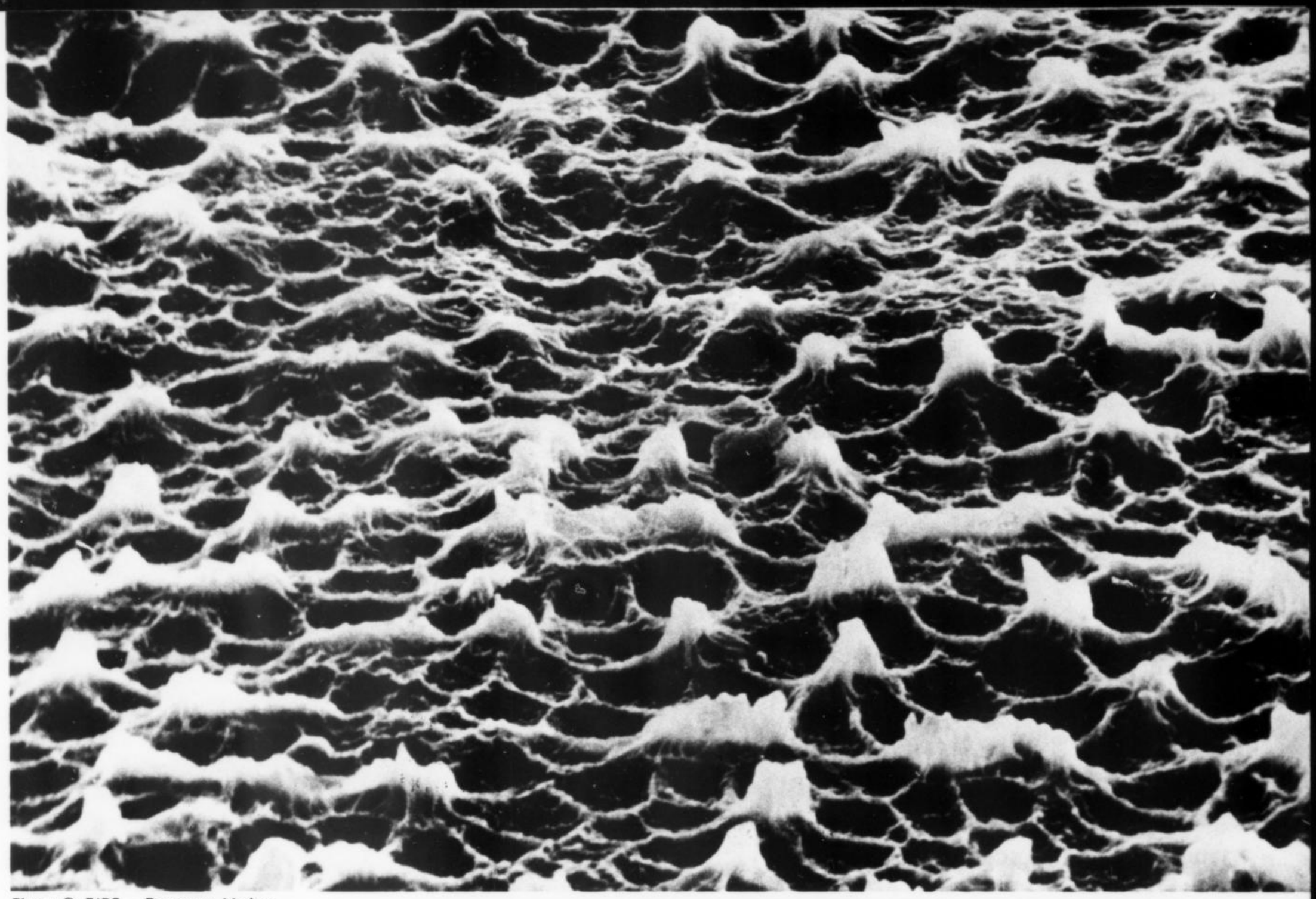


Photo © BIPS - Rassegna Medica

Photographed with a scanning electron microscope, the surface of the human trachea, or windpipe, recalls a storm-tossed ocean. Here the delicate mucose membranes of the trachea have been magnified 2,500 times.

Hidden factors in the 'geography' of cancer

by Nedd Willard

EARLY in the morning as the farmers get up to start their chores, before it is even light, the rain starts falling. It keeps falling throughout the day covering Brittany with an all too familiar veil. But without the rain there would be no herds of cattle for making butter. When work is over, when a farmer meets a friend or an errand takes him to the nearest village, a glass or two of wine or a stiff drink of calvados seems to shut out the cold and damp and make a hard life easier and friendlier.

In Curaçao the sun shines every day, except during the rainy season and even then it may come out and pay a visit for a few hours or so. Vegetation is lush and warm waters gently wash the shores of the tropical island. In spite of the climate the favourite dish is funchi, a maize porridge served piping hot. Night comes quickly, with little transition from the brightness of day to the velvet obscurity of night. To the sound of music people sit sipping their drinks. Music seems to sound better that way.

Brittany and Curaçao, what two places could be more different? Yet they have one thing in common, something unpleasant: a high rate of cancer of the oesophagus, the tube between the mouth and the stomach. This sad distinction they share with Jamaica and the uplands between Kenya and Uganda. A number of investigators spurred on by the International Agency for Research on Cancer (IARC) are hard at work trying to find out why.

The IARC was created in 1965 by the World Health Assembly and forms part of WHO. Its main attempts are to find what in man's environment causes cancer. Some elements identified so far are man-made. Pesticides are being studied, for example, but others seem to occur naturally.

In Nairobi, Dr C.A. Linsell, Chief of

CONTINUED NEXT PAGE

NEDD WILLARD *is a medical writer on the staff of the World Health Organization.*

Is the secret hidden in the soil?

the Centre set up by IARC, co-ordinates the material which is gathered along the Kenya-Uganda border by the Medical Research Council of Great Britain with his own research.

In France, Dr A. Tuyns, a member of the Agency staff, is studying oesophageal cancer in man in Brittany in collaboration with the Rennes School of Public Health and Professor Louis Massé. In Jamaica, Professor G. Bras heads the Agency centre. In Curaçao, Dr U. de Jong of the Agency is at work on the spot profiting by the co-operation of the Curaçao cancer registry. And so the net to gather vital data has been spread over vast distances, and covers quite different climates and ways of life.

The dominant idea behind this research is that if regions like Brittany and Curaçao differ widely in most characteristics, it might be possible to find those they share and so eventually isolate the factor responsible for causing such a high rate of cancer of the oesophagus..

One distinction can be made, based on the different incidence of the disease between the sexes. In Brittany and Jamaica, it is primarily the men who are subject to the disease. In Curaçao, the rate is high among both sexes.

But the first nagging question remains, what common link can there be between a rugged peninsula jutting into the cold Atlantic sea, a tropical island bathed in sunshine, and the uplands of a continental plateau? One fact which struck observers immediately was a certain liking people of these regions share for their local alcoholic beverages or, in the case of Curaçao, for their hot maize porridge. The Bretons down large draughts of calvados while the people of Malawi, far away in Africa, like their home-made gin.

Studies have shown that at least home-made Malawi gin contains nitrosamines, chemicals which can provoke oesophageal cancer in animals. If samples of the drinks or food in these regions reveal the presence of nitrosamines in large quantities this may prove significant.

But Curaçao, Trinidad, Brittany and Malawi are still thousands of miles apart. This makes study more difficult and the job of eliminating all extraneous factors almost overwhelming. Therefore, the discovery of three regions in the same country, geographically quite close together, with three different patterns of oesophageal cancer proved to be the starting point for a unique supporting study. Scientists had found a natural microcosm in which to study this form of cancer.

Along the northern coast of Iran, on the Caspian Sea, lie three regions with very different climates and life patterns.

The first region is heavily forested, well-watered land where the main crops are tea and rice. Further east up the coast lies an intermediate region where there is some rainfall and cotton fields predominate, although there are a variety of activities including tourism and fishing. Finally, slightly inland from the coast, lies a semi-desert region, a region of camels and thirst, of poverty and nomadic huts. Three regions, only a short distance apart; three ways of life, three climates and soils, three strikingly different patterns of cancer of the oesophagus.

The dry region of Gonbad-Gorgan has the highest incidence, 50 to 70 cases per 100,000 people. The intermediate region is between the two extremes with about 15 per 100,000: the well-watered area, or rainbelt, has only about 6 per 100,000. The question seeking an answer is, why?

To find out, a start was made on this problem by a team in the summer of 1968. Dr Ezat Mahboubi, of the Institute of Public Health in Teheran, organized a cancer registry in the spring of 1968 as part of a joint research agreement with IARC. Dr Janet Kmet, an IARC staff member works closely with a team of physicians and technicians who permanently scan the Caspian littoral collecting all available information from local doctors. The research base is at Babol, in the field research station which has been given

Why do certain types of cancer afflict particular regions? In northern Iran, on the Caspian sea, three adjacent regions, having very different climates, types of soil and patterns of life, provide research workers with a natural field of study. The incidence of cancer of the oesophagus varies widely from one region to another. There seems to be a relation between the humidity and the salinity of the soil and this type of cancer. But many factors have to be distinguished and compared before a definite conclusion can be reached. So a research station was established last year at Babol where information from local doctors is collected.

1. Far left, fishermen on the Caspian Sea. In this wooded, well-watered region the incidence of cancer of the oesophagus is low. (6 per 100,000 of the population.)

2. In the cotton-growing Babol region, left, the rainfall is less extensive than on the Caspian coast. Cancer of the oesophagus affects 15 out of 100,000 of the population.

3. Right, the arid zone of Gonbad-Gorgan is inhabited by nomadic tribesmen and here the incidence of oesophageal cancer is about ten times higher than it is among the Caspian fishermen (50 to 70 per 100,000 of the population).

Photos © Paul Almasy, Paris

for the study by the Iranian Institute of Public Health Research.

Dr Kmet hopes, by studying the physical, biotic and cultural characteristics of the Caspian littoral, to discover new techniques for understanding the environmental factors in cancer.

The region chosen in Iran has many unique advantages. Within a small distance, there are striking changes in climate and soil; Dr Kmet strongly suspects that the humidity of the climate and the salinity of the soil play a part, but before incriminating one or two factors, many others must first be examined and acquitted.

In the desert region of Gonbad, people have a habit of drinking large quantities of tea, scorching hot. It was plausible that this fiery flood of liquid poured down the soft linings of the gullet would over the years instigate cancer. It seemed reasonable, but it wasn't true: people in the neighbouring regions who don't suffer a high incidence of oesophageal cancer also like to drink their tea scalding hot. Moreover, women in Gonbad do not drink more tea, yet they have a higher incidence of oesophageal cancer than the men.

So many things are involved that finding the factors responsible for human cancer requires long efforts in various disciplines. The way of life—a vague term—can be broken down into a thousand component parts, any one of which may be important.

How do the people work? What do people eat and drink? Finally, the place itself, the climate and the soil on which the community lives and from which it draws its sustenance has to be studied. According to Dr Kmet, the evidence collected so far seems to suggest that low rainfall and high salinity in the soil are related to the oesophageal cancer problem.

A geographical concordance between humidity and salinity of the soil on the one hand, and the distribution of oesophageal cancer on the other, has been clearly shown, but it may be coincidental. Where there are saline types of soil there is a high incidence of this disease, at least in the vast areas of central Asia. These findings generally fit well with the high incidence of oesophageal cancer on the Iranian plateau.

The findings in Kazakhstan in the U.S.S.R. support the hypothesis of a causal relation, since the border between saline soil types in the coastal areas and non-saline soils in the forest and *chernozem* districts north and west of the northern shores of the Caspian Sea is a disease dividing-line similar to those found in Iran. Something similar has also been noted in Kenya.

But clues are not proof and every factor must be weighed, compared and sifted. For facts to be accurate and comparable, they must be gathered in a uniform way. The team therefore set out to standardize the observations to be gathered in the field research station at Babol. Located in the intermediate region, it already serves as a coordination centre for the data collected with the aid of three hundred doctors.

These physicians send in biopsies which are examined in the laboratory. The pathologist, Dr Salmasizade, and the head of the registry, Dr Falati, go out themselves to visit each local health centre as well as physicians in the region in order to check on cancer reports. A large map is being drawn up to show the areas where the different forms of cancer—oesophagus, lungs and other sites—are occurring.

The road leads out through the desert dotted irregularly with the *yourtas* of the nomads. This traditional way of life still stretches its tents from Iran to the edge of China.

Region two lies midway between desert and rainbelt. The way of life differs from that of the desert although the diet is about the same. The Babol research centre is at the hub of this region. Here is where the precious files are accumulated and studied.

Chaluz lies in the heart of the rainbelt, Region three. The plants sparkling with dew emphasize the life-giving humidity here. Children are out at work harvesting weeds from the rice fields to feed the livestock. On the coast, the fishermen embark for a day at sea. Here the number of cases of oesophageal cancer reported is very low.

The road rises through the clouds and breaks the rain barrier to emerge on the other side, where the way leads to Teheran. Behind the mist lie three regions where diets are similar, although occupations differ. Where does the difference lie? The answer may be hidden in the dirt under foot. ■

XUM

Air pollution and lung cancer

by R.E. Waller

THE possibility that air pollution might be a factor in the development of lung cancer was first considered nearly forty years ago. The classical work of Prof. Ernest Kennaway and his associates in London had shown that compounds capable of producing tumours when painted on mouse skin could be isolated from coal tar, and it was recognized that these compounds were likely to be present too in urban air polluted by coal smoke.

Lung cancer death rates were above average among men working in industries where coal was distilled, and in Britain, America and in many countries of Europe the number of deaths attributed to this disease in the general population was increasing from year to year.

At first it was widely thought that improvements in diagnostic procedures, and their greater availability throughout the countries concerned, were responsible for much of the recorded increase in lung cancer, but by the time the Second World War interrupted the regular study of mortality trends, in 1939, it was clear that there must have been some real increase in the incidence of the disease.

In England and Wales, Dr. Percy Stocks Chief Medical Statistician, found substantial differences in lung cancer mortality between different towns, and a general tendency for death rates to be highest in London and the large industrial towns, declining gradually with size of town, to the lowest rates in rural areas.

Although there was some evidence that availability of hospital services was a relevant factor, these findings, coupled with the known carcinogenic action of products from the distillation or incomplete burning of coal, soon suggested that air pollution might be concerned in the development of lung cancer.

At the time, there were reports from Germany of an association between smoking and lung cancer, and carcinogenic "tars" had been produced by a number of workers by the distillation of tobacco. Thus when plans were made after the war for further studies on the cause of the ever rising incidence of lung cancer, smoking as well as air pollution was considered as a possible factor.

Epidemiological studies were started in Britain and in the United States, among hospital patients with lung cancer, and these led, by 1950, to a clear demonstration of the association between cigarette smoking and lung cancer.

Simultaneously, work was in progress on the presence of carcinogenic substances in urban air, and one of the compounds already isolated from coal tar, benzo(a)pyrene, was found to be widely distributed in the air of towns in Great Britain. The amount present varied roughly with the size of town, and its chief source appeared to be domestic coal fires, though small amounts were also present in the exhaust products from motor vehicles. Detailed studies of local differences in lung cancer death rates in England and Wales still showed a general relationship with size of town, and there appeared to be a close correlation with various indices of pollution by coal smoke.

All these findings were discussed at an international symposium in Louvain in 1952. It was clear then that there had been a real and rapid rise in lung cancer mortality in all the developed countries of the world from which reliable data were available. Death rates were particularly high in Austria, Great Britain and many other countries of Western Europe.

In all cases the increase had, up to that time, been much greater among men than among women. There was also evidence of an "urban excess" of lung cancer even in countries such as Denmark, where the towns did not suffer much from air pollution problems.

MANY features of the trends in mortality could be explained in terms of the established association with smoking. It was cigarette, rather than pipe or cigar smoking that led to an increased risk of lung cancer, and although in many countries the overall consumption of tobacco had not changed much, there had been a massive swing from pipes to cigarettes during the first half of the century. The much higher incidence of lung cancer among men than among women was in keeping with their heavier and longer history of cigarette smoking.

Air pollution did not fit into the picture as a major factor, for in countries where the increase in lung cancer had been most rapid there had not been any general increase in pollution. In Great Britain in particular, pollution by coal smoke had been worse at the beginning of the century than it was in 1950. It remained possible however that the carcinogens in coal smoke played some part in

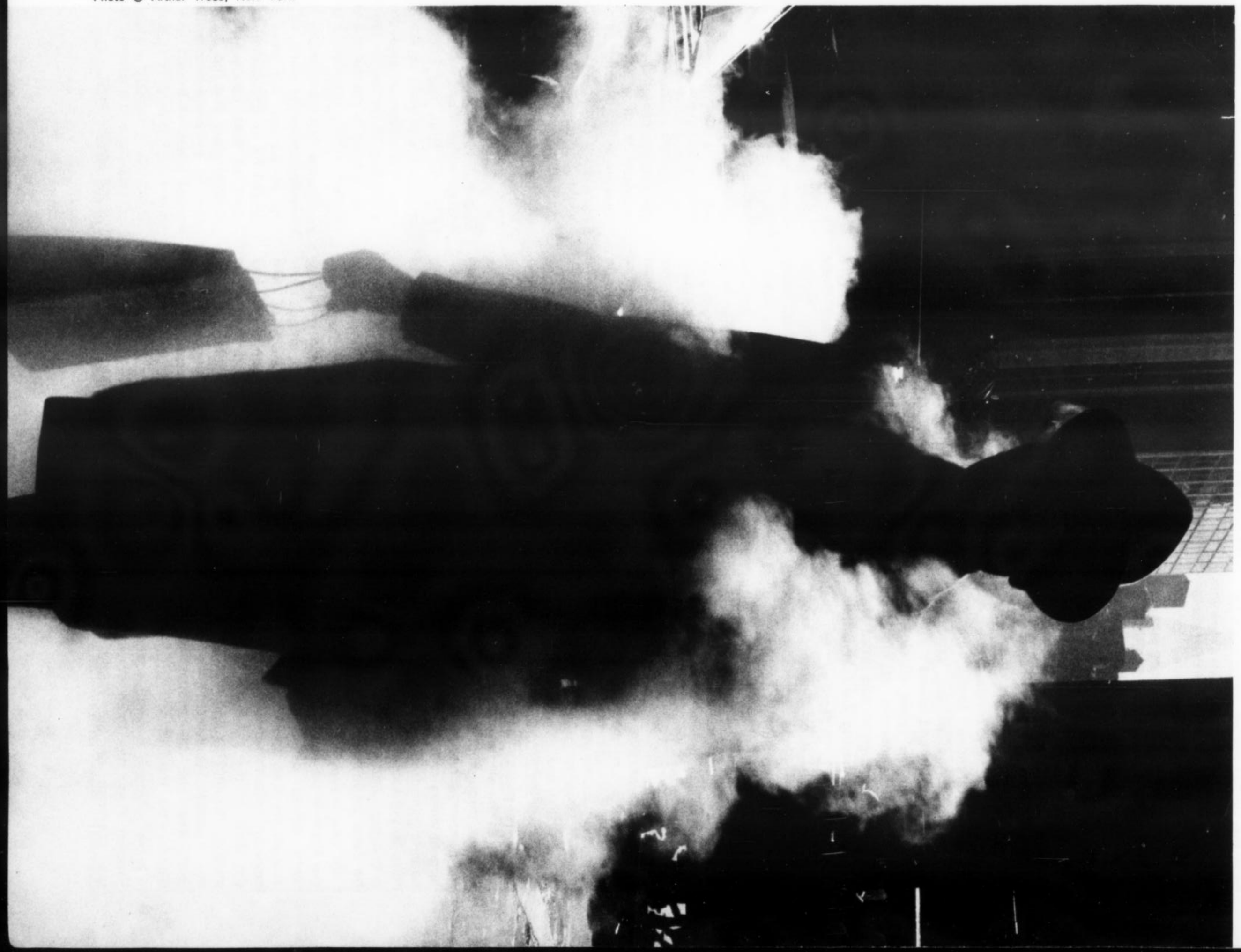
CONTINUED PAGE 32

R. E. WALLER *is a member of the Medical Research Council's scientific staff in the Air Pollution Unit at St. Bartholomew's Hospital Medical College, London. He has studied the role of air pollution in relation to lung cancer and bronchitis for more than 20 years. He will be one of the chairmen of the panel on Air Pollution and Cancer at the 10th Cancer Congress, in Houston, Texas, this month.*

XUM

MUSEUM

Photo © Arthur Tress, New York



Extra bonuses for smoke-free city dwellers

conjunction with smoking or that new forms of pollution were of special significance.

One of the reasons for retaining an interest in the possible effect of air pollution was the high lung cancer death rate in Great Britain as compared with the United States, despite similar smoking histories.

Although it seems likely that some of this difference is accounted for by the American habit of throwing away a larger proportion of each cigarette, it has been shown that British emigrants to South Africa, Australia, New Zealand, Canada and the United States have higher lung cancer death rates than the native residents of these countries, though lower rates than those of the compatriots they leave behind.

These differences cannot be explained in terms of the extent of cigarette smoking and unless there are differences in the types of cigarette smoked or the manner of smoking, these results suggest an extra risk introduced by having lived in Britain.

Emigrants from Norway to the United States have, on the other hand, rates that are higher than those of Norwegians who stay in Norway and lower than those of American-born residents of the United States. Whilst it may be that emigrants are selected sections of the population, making it difficult to draw firm conclusions from these results, the implication is that the overall exposure to pollution modifies the lung cancer death rates.

SINCE 1950 surveys of benzo (a)-pyrene and other carcinogens in the air have been carried out in cities throughout the world. Whilst the concentrations found are in general largest where coal is used for domestic heating purposes, some benzo(a)pyrene is produced in other combustion processes, and this compound can be detected in most urban areas.

In one survey in North Wales and the North West of England, the results were linked directly with detailed studies on lung cancer mortality and smoking. Death rates increased from the least to the most polluted areas among non-smokers and among all but the heaviest smokers, but smoking itself was still the major factor in determining the rates.

More recently, a small scale international study has been done under the auspices of the World Health Organization. Lung cancer mortality, pollution and smoking were compared first in Belfast and Dublin, chosen as cities of similar size (500,000 population), with similar social conditions. The higher death rates found in Belfast were not wholly accounted for by differences in smoking habits, but they were in accord with the higher concentrations of smoke and benzo(a)-pyrene found there.

On the other hand, when the study was repeated in Oslo and Helsinki, the relatively high death rates in Helsinki did not indicate any effect of pollution, since the concentrations of smoke and benzo(a)pyrene were lower there than in Oslo, and the differences in death rates appeared to be due to differences in smoking habits.

The findings from this survey emphasized the limited value of surveys of pollution at the present time. With modern oil heating installed in most buildings, the concentrations of smoke and the associated benzo(a)pyrene were very low in Helsinki, but it seemed likely that they would have been higher some years ago, when other forms of heating were in use.

A similar situation exists now in Great Britain: London and other large cities that suffered severely from pollution by coal smoke earlier this century are now relatively clean, due mainly to the operation of the Clean Air Act (1956). Surveys of pollution at the present time therefore provide little guide to the lifetime exposures of people now of "lung cancer age".

Continuous monitoring of urban concentrations of pollution from now on could provide results to link with future mortality experience. It is doubtful however whether large scale analytical work to determine the concentrations of benzo(a)pyrene and related carcinogenic compounds in cities throughout the world is justified.

Such evidence as there is from men exposed occupationally to large concentrations of these compounds suggest that their effect on lung cancer mortality is small. A study of men employed in the production of coal gas in Great Britain showed that retort house workers had a slightly increased risk of developing lung cancer, as compared with the general population, but the concentrations of benzo(a) pyrene in which some of them worked were of the order of 100 to 1,000 times those in normal urban air.

It has been suggested that pollution from motor vehicles, containing small quantities of benzo(a)pyrene, may be of interest in relation to lung cancer, but there is no evidence of any marked excess of this disease among men who work in close proximity to motor exhausts, e.g. as maintenance men in garages, as policemen on point duty or as drivers of goods or passenger vehicles.

ALTHOUGH it is now clear that air pollution cannot be a major factor in the development of lung cancer, there is still an "urban factor" in the mortality statistics in all parts of the world. Commonly, lung cancer death rates in large towns are two to three times those in rural areas, but against this must be set the finding that cigarette smokers as a whole have death rates that are about 20 times those of non-smokers.

Thus any differences in smoking habits between town and country are likely to have a large effect on death rates, and the present situation may be a legacy of lower levels of cigarette smoking in rural areas thirty or more years ago, even though current smoking habits are similar in town and country.

In Britain an interesting situation is developing now, for the end of the increase in male lung cancer death rates is in sight, and among middle-aged men there are even signs of a slight decrease. The trend is most marked in London, whilst in rural areas death rates are still rising at all ages.

This slight erosion of the "urban factor" could be due to the levelling out of smoking habits, or merely to selective movements of population between town and country, but it is of possible interest in relation to changes in pollution, since there has been a marked reduction in the amount of coal smoke in the air of London, particularly during the last 10 to 15 years.

It may be many years before the reasons for these changing trends can be sorted out, but even if the part played by air pollution in the development of lung cancer is small, it is already clear that the dramatic reduction in smoke concentrations in the major cities of Britain has had many beneficial effects, including reduced effects on bronchitic patients, increased visibility and a general improvement in the environment. ■

Letters to the Editor

TRICKS OF THE SPIDER'S TRADE

Sir,

It is always a pleasure to open your magazine and find the special kind of article one never sees in other publications. I enjoyed Hans Jenny's article on the Sculpture of Vibrations (December 1969) but one aspect was missing, namely, sound films. Walt Disney utilized this means by screening images from the sound track of a film during the interval in his full-length musical, "Fantasia", and the effect was extraordinary.

Another example of the unusual in the same issue was the analysis of the building of a spider's web. As a naturalist I read this eagerly, but, alas!, I did not find the answer to an enigma that puzzles everyone, including the young people I teach: Before the first phase of web construction, how did the spider "leap the gap" between the log cabin and the hazel bush?

Abbé Henri Debisschof
Lille, France

When a spider climbs up on a blade of tall grass or a branch it pays out a silken thread which, carried by the wind, becomes attached to another plant some distance away. When there is no wind, or if the spider is spinning indoors, it begins by attaching its line to some object (indoors) or plant (outdoors) then unwinds the thread as it moves down the supporting branch or object. After moving for 20 to 30 centimetres, it climbs on another support, tightens the line, attaches it, and begins the basic construction of the web.

With regard to the sequence in Walt Disney's "Fantasia", this was a visual representation of the patterns on the sound track of the film. It was a purely visual creation, having no relation with sound vibrations produced from solid particles—Editor.

PIONEER OF WORK CAMPS

Sir,

Service Civil International was the first organization to sponsor work camps as meeting places where youth could exchange ideas and build friendships in the service of Peace and better understanding between peoples. This year Service Civil International celebrates its fiftieth anniversary. We feel that this provides an ideal occasion to show to a wider public how the notion of work camps and long-term service has developed throughout this period.

Ralph Hegnauer
International Secretary
Service Civil International
Geneva, Switzerland

NOISE POLLUTION

Sir,

I was enchanted by your issue on cymatics, the sculpture of vibrations (December 1969). But I would like one issue to be devoted to "noise", as you did for water or air pollution. Noise has become a terrible enemy of mankind, and we are all simply heading for nervous breakdowns consciously or unconsciously. Not enough material is available. I have given a few passages as class-work on the subject, but I and other teachers and educators need much more material, and presented in a more scientific way.

Bianca Romano
Tel Aviv, Israel

Our reader must have missed our July 1967 issue entirely devoted to the harrowing problems of noise in modern society—Editor.

HIGH QUALITY - LOW PRICE

Sir,

I cannot understand how you can provide such a high quality magazine at such a low subscription price. I am amazed. All I can say is that the magazine and its price reflect the quality of the organization and its goals.

Alan Coupe
Vancouver, Canada

' COURIER ' IN THE CLASSROOM

Sir,

Your magazine has been a source of cultural information for me and my family for years, and as a school teacher I have always enjoyed sharing its contents with my students in the classroom. Thank you for your contributions to world education and possibly to better world understanding and peace.

Richard Rivard
Tiverton, R.I., U.S.A.

SCHOOL-AGE SMOKERS

As a regular reader of your magazine for many years, may I compliment you on the high standard of your issues and your choice of interesting subjects. One worthy of special praise is the theme "Can We Keep Our Planet Habitable?" (January 1969).

Since education is one of your chief concerns, I suggest you tackle the problem of tobacco, particularly as it affects young people.

With the acquiescence of educational authorities, youngsters in school are surrendering to the smoking habit at increasingly earlier ages. The effects of this are disastrous: intellectually, morally and physically. As a teacher I say that we should act at once to put a stop to this.

Georges Moureaux
Oyonnax, France

FORUM FOR YOUTH

Sir,

In your issue, "Youth 69" (April 1969), I was struck by the sound opinions offered by sociologists and other specialist authors of your articles. It is reassuring to find that we, the younger generation, are understood by at least some adults.

But I feel that something was lacking in the issue—perhaps the most important thing of all: the views of young people expressed by themselves. I think you should plan an issue on these lines and announce it well in advance so that many young people would have a chance to send you their ideas on the problems of modern youth.

Jean-Claude Hassan
(aged 15) Tunis, Tunisia

We welcome our reader's proposal and would be glad to hear from young people everywhere on the problems of youth—Editor.

PRIORITY FOR PEACE

Sir,

I have subscribed to the "Unesco Courier" for four years, and not only my own large family but my friends too read it through from cover to cover. You present many world problems, and in my view the impact of each issue continues long after its publication. I believe that 20th century man has knowledge enough to overcome all problems. The most crucial one is how to maintain world peace, so you should give it top priority.

A.M. Byelomestnykh
Smela, U.S.S.R.

REAL 20TH CENTURY EVIL

Sir,

Congratulations for the February 1970 issue. Your evaluation of the Pearson Report is excellent, and brings to mind the superb play written for U.N. radio in 1950 by Norman Corwin, entitled "Could Be". In his dramatic portrayal of a "Peace Blitz" by hundreds of thousands of the world's citizens, Corwin the artist showed the way to Pearson the statesman and planner.

It is worth recalling the statement by Pope John XXIII: "Narrow nationalism is the real evil of the 20th century." The "Unesco Courier" is doing an excellent work in helping to lead the way out of that "narrow nationalism".

C. N. Richardson
Laguna Beach
Calif. U.S.A.

HEADING FOR ASPHYXIA?

Sir,

How about an issue on oxygen, and the world oxygen supply? After all, what is the point of drilling for oil if there won't be enough oxygen left to keep us alive after the oil is burned?

M. J. Nicol-Griffith
Pointe Claire, Canada

DWINDLING WOLVES

Sir,

I know very well what is happening to the world's remaining wolves, but are many people aware of this problem of near extinction? I think an issue with all the facts would be very helpful. It would be appreciated by many readers and not merely by conservationists and animal lovers.

Ian Schweninger
Boulder, Colo. U.S.A.

UNESCO NEWSROOM

Training the cell scientist

Unesco and the International Cell Research Organization (ICRO) are offering new training facilities to young scientists. Fellowships in microbiology will enable scientists from developing countries to train for nine months in research laboratories abroad. A Unesco-ICRO training course on animal viruses and host cells will be organized by the Institute of Virology of the Slovak Academy of Science, at Bratislava, from September 14 to October 10, this year.

Sampling the ocean bed

Drilling crews on the U.S. oceanographic research ship, "Glomar Challenger" have recovered over four miles of sediment material from ocean beds during the first 18 months of the U.S. National Science Foundation's Deep Sea Drilling Project. Seventy-five scientists from 15 countries were members of ship-board scientific staffs during cruises in the Gulf of Mexico, the Caribbean Sea and the Atlantic and Pacific Oceans, completed last January. Drilling records were established for the deepest water worked (20,146 feet) and the deepest penetration of the ocean bed (3,230 feet).

Men and Medicine in the Middle East

An assessment of public health progress in an area stretching from Tunisia to Pakistan, and an account of the medical legacy of the great Middle Eastern civilizations are presented in "Men and Medicine in the Middle East", recently published by WHO. Among other achievements it reports: medical manpower tripled; a 30 per cent drop in infant mortality rates in several countries; smallpox incidence reduced to a fraction of the 1950s level (See Bookshelf).

Poland's student volunteer workers

Student Voluntary Labour Brigades in Poland work on building projects, in agriculture and forestry, thus helping to ease labour shortages during the summer months. In their free time the students organize cultural and educational lectures, sporting and social events in co-operation with local authorities. In 1969, 47,000 students, including 500 from neighbouring countries, worked during the vacation months.

Extinction threat to vicuna

Of the 200,000 vicuna in Peru ten years ago only 20,000 now remain, and the species will die out unless drastic measures are taken to protect them from mass hunting says an FAO report. Vicuna are prized for their fine soft wool, but the animals are difficult to round up for shearing and poachers shoot them to obtain a quick profit. The Peruvian government is training more gamekeepers to patrol its 125,000 acre game reserve in order to halt the mass killing.

A World to Gain

"A World to Gain", a handbook issued by the U.N. National Commission for Unesco in co-operation with the U.S. United Nations Association and the National Education Association, explains the background to International Education Year 1970. It aims to help non-governmental organizations in planning IEY activities throughout 1970.

Food aid for Yugoslav earthquake victims

Over 17,000 Yugoslav school children at Banja Luka, which was devastated by two earthquakes in October 1969, are to receive food rations for three months from the World Food Programme, the agency set up by FAO in 1961. The earthquakes left 8,000 families homeless, and half of the city's 60,000 population had to be evacuated. The 17,000 school children who remained in the town are at present being fed by the Yugoslav government.

War on food predators

The Indian Pest Control Association has submitted a scheme to the Indian Government for reducing the ravages of rats and insects which destroyed 13 million tons of food grains during 1967-68. The scheme would cost 2,400 million rupees, but would achieve an estimated saving of 11,250 million rupees over a 5 year period.

'Clean up' plan for Europe

A six-point plan for improving living conditions in Europe has been proposed by Sweden's Minister of Agriculture, Ingemund Bengtsson. He advocates careful planning of new urban areas, high-degree purification of sewage, a reduction in the sulphur content of heating oils, centralized heating plants, promotion of communal transport systems as an alternative to private cars and more stringent anti-exhaust fume laws.

Language laboratory for nuclear technicians

Hundreds of scientists and technicians employed by CERN (the European Organization for Nuclear Research) at Meyrin, near Geneva, Switzerland, have recently been working in a different kind of laboratory: CERN's new language laboratory which is equipped with the latest audio-visual teaching devices. Crash courses in English, French and Russian for these nuclear specialists are then supplemented with traditional instruction in written language, grammar and spelling.

BOOKSHELF

RECENT UNESCO BOOKS

■ **Catalogue of Reproductions of Paintings 1860 to 1969**
9th edition, completely revised, 1969 ($8.50, 51/-)

■ **Films on Traditional Music and Dance**
A first international catalogue
Compiled by the International Folk Music Council, London; edited by Peter Kennedy
1970 ($5.50, 33/-)

■ **What is Unesco?**
(Unesco Information Manuals) 1970

■ **Cultural Rights as Human Rights**
(Nº 3 of Studies and Documents on Cultural Policies) 1970

■ **Four Statements on the Race Question**
(Unesco and its Programme) 1969

★

LANGUAGE AND LANGUAGE LEARNING

■ **Modern Language Teaching**
(Papers from the Uppsala Congress on Modern Language Instruction)
Edited by Hans Jalling
Oxford University Press (OUP)
London, 1968 (12/6)

■ **Language Testing Symposium**
A Psycholinguistic Approach
Edited by Alan Davies
OUP, 1968 (15/-)

★

■ **Population and Food Supply**
(Certificate Topics in Geography)
By Michael Morgan
Collins, London and Glasgow, 1969 (10/-)

■ **Men and Medicine in the Middle East**
Published by the World Health Organization Regional Office for the Eastern Mediterranean
Text by Jan Simon
Available in English and Arabic from WHO Regional Office, P.O. Box 1517, Alexandria, U.A.R.

Flashes...

■ *A tool believed to be 2,200,000 years old has been unearthed in Ethiopia. A piece of quartz, sharpened on both sides, it was discovered by French archaeologists on a site near the Omo River.*

■ *Women comprised 50% of the labour force in U.S.S.R., 37% in Germany (Fed. Rep.), 36% in U.K. and U.S.A. and 35% in France in 1966, says a recent OECD report.*

■ *The United Nations General Assembly has asked the U.N. Secretary-General to study the feasibility of establishing an international university.*

■ *As its 900th major pre-investment project, the United Nations Development Programme is helping the Government of Malaysia to set up a fishermen's training centre in Penang.*

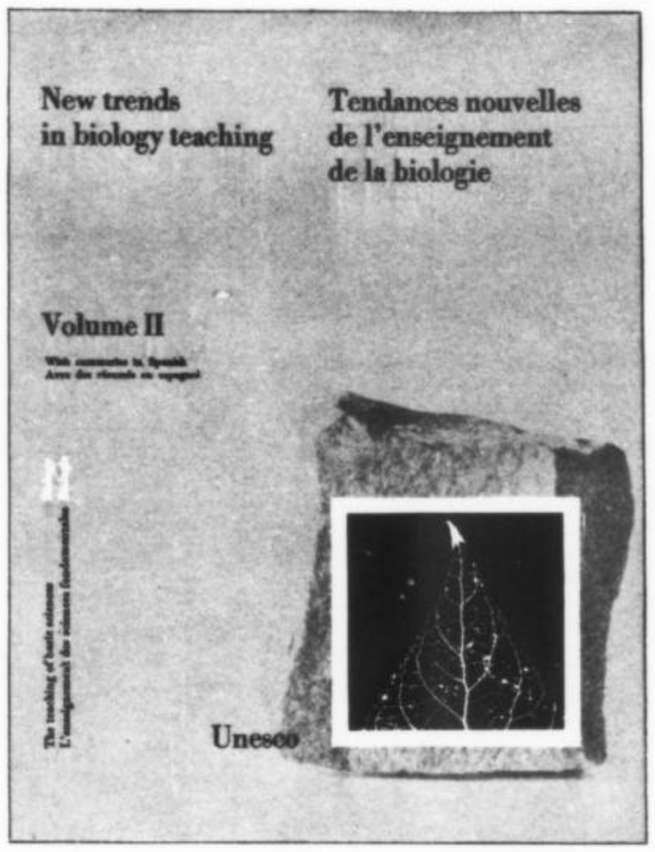
■ *Byelorussia is launching a major programme for the preservation and conservation of its monuments and architectural sites. Under a recent law all historical monuments are accorded government protection.*

Imp. GEORGES LANG, PARIS. IMPRIMÉ EN FRANCE. — Dépôt légal. 2e trimestre 1970 - C 1

Just published

NEW TRENDS IN BIOLOGY TEACHING

Volume II, 368 pages, $5.00



Composite: 17 articles in English, 9 in French, all with summaries in Spanish.

...in the Unesco series

THE TEACHING OF THE BASIC SCIENCES

An international exchange of information on up-to-date approaches, content, curricula and techniques in the teaching of the basic sciences. Includes papers presented at congresses and seminars, original articles and reprints from professional journals. All volumes composite : English-French, with summaries in Spanish.

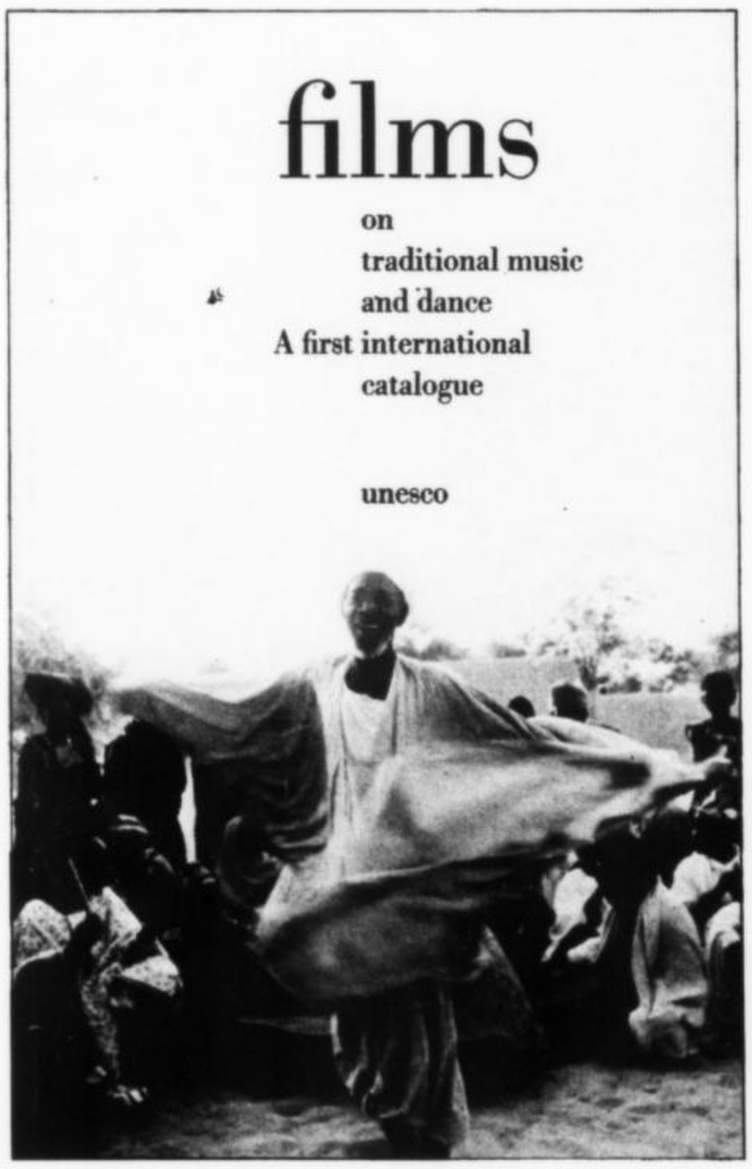
The series includes:

- **NEW TRENDS IN BIOLOGY TEACHING**
  Vol. I (1966) 2nd imp. 1968, 298 pages, $4.50.
- **NEW TRENDS IN CHEMISTRY TEACHING**
  Vol. I (1964-1965) 2nd imp. 1968, 359 pages, $7.00.
  Vol. II 1st imp. 1969, 407 pages, $7.00.
- **NEW TRENDS IN PHYSICS TEACHING**
  Vol. I (1965-1966) 2nd imp. 1968, 271 pages, $6.50.
- **NEW TRENDS IN MATHEMATICS TEACHING**
  Vol I (1966) 2nd imp. 1968, 438 pages, $6.00.

Films on traditional music and dance

A First International Catalogue

- **Lists films of authentic folk dance, song and instrumental music, together with associated customs and ceremonies in 99 countries.**
- **A useful guide for cultural and educational centres and television stations. An up-to-date listing of over 380 films available for hire, purchase or exchange.**
- **Published by Unesco and edited by Peter Kennedy for the International Folk Music Council, London.**

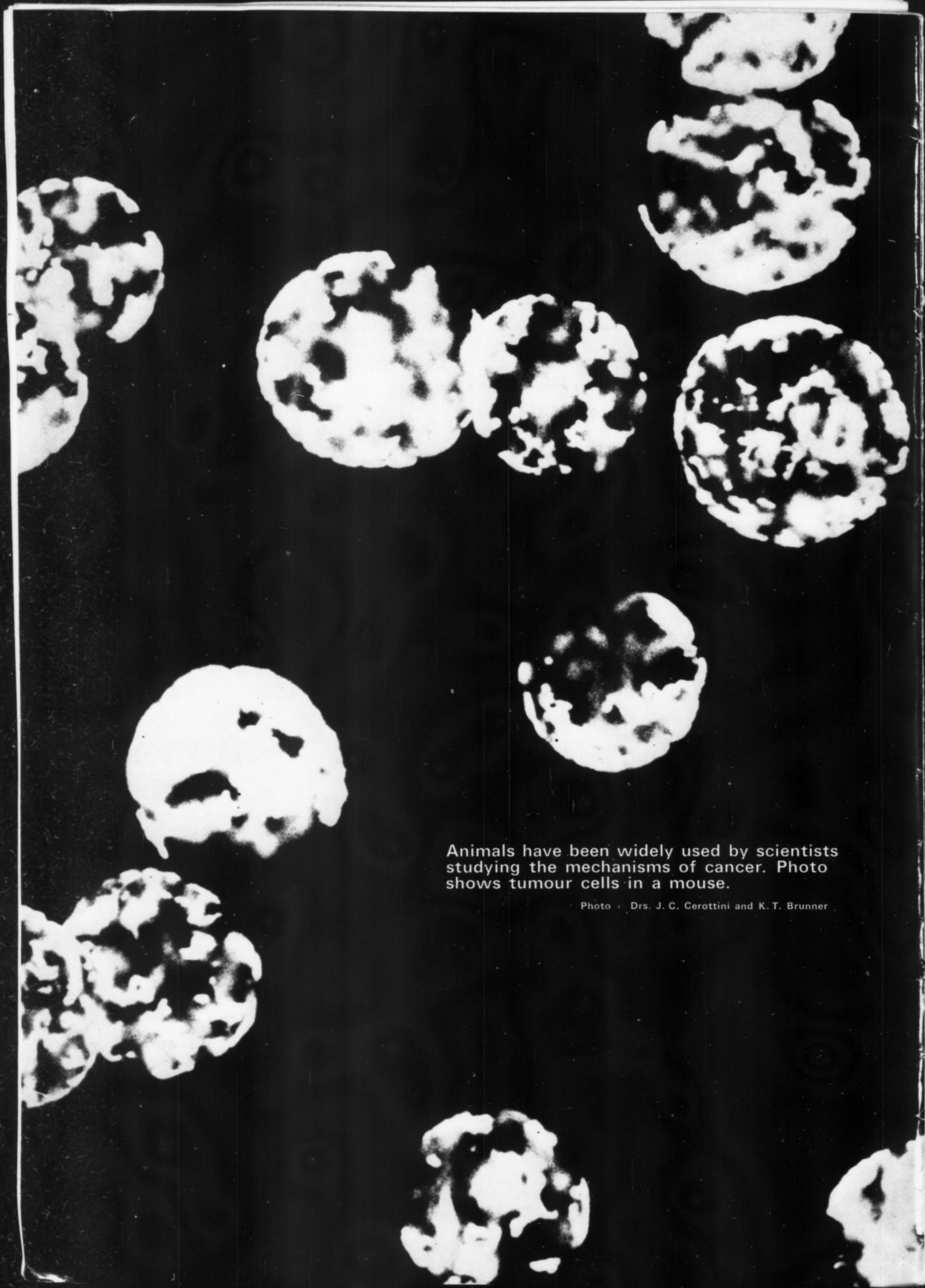


261 pages $5,50

Order from:

UNIPUB. INC. (UNESCO PUBLICATIONS CENTER) P.O. BOX 433, NEW YORK, N.Y. 10016

XUM



Animals have been widely used by scientists studying the mechanisms of cancer. Photo shows tumour cells in a mouse.

Photo : Drs. J. C. Cerottini and K. T. Brunner

XUM

XUM